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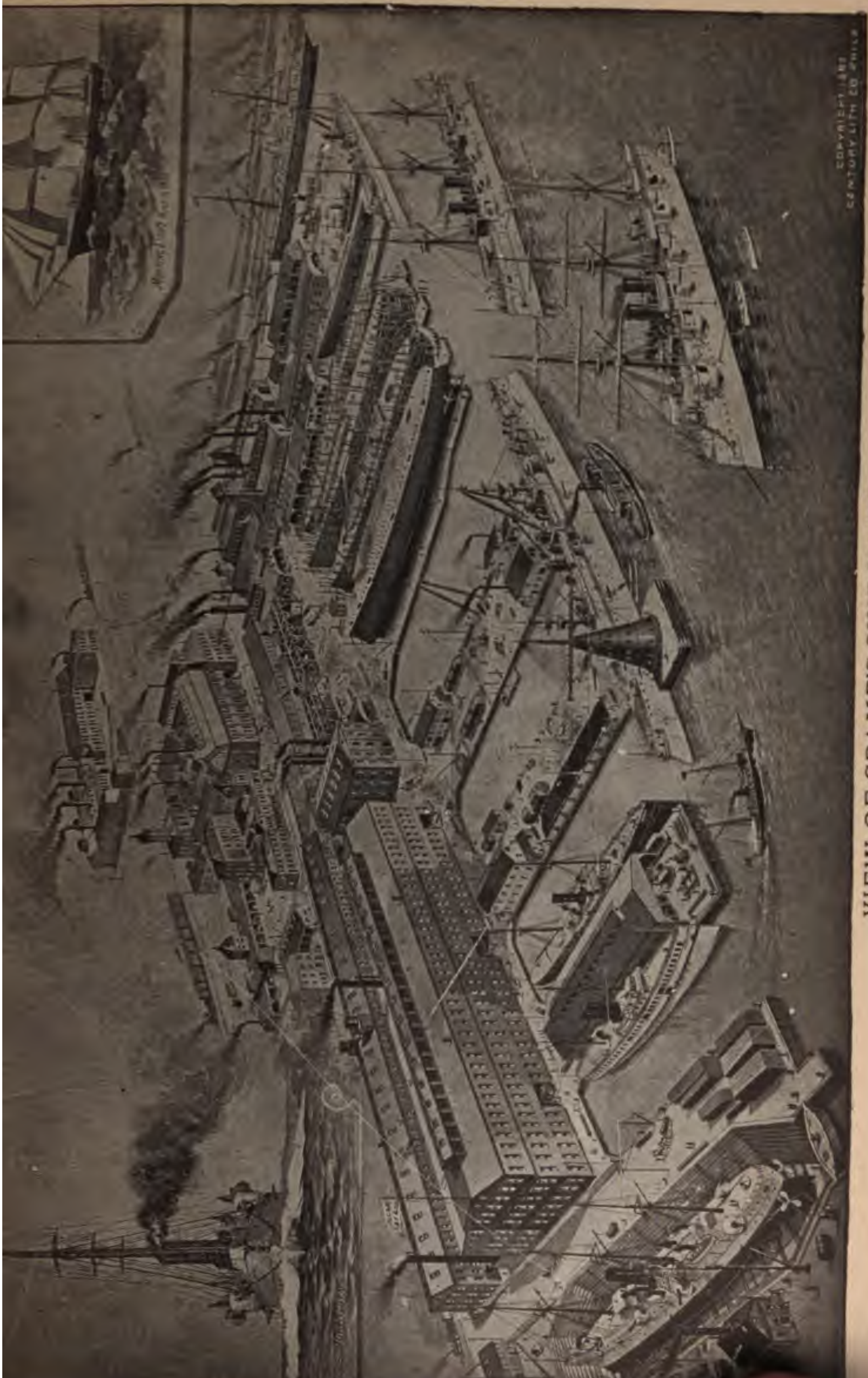

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE MANEUVERS BETWEEN THE NAVY AND THE COAST ARTILLERY.*

SEPTEMBER, 1902.

By MAJOR JOHN P. WISSER, U. S. A.

The recent maneuvers between the Navy and the Coast Artillery were practically the first of their kind which received the full sanction and the free encouragement and entire sympathy of the authorities concerned. Some two years ago, due to the efforts of energetic and enthusiastic Navy and Army officers, maneuvers of this kind took place, but on a limited scale, and without the hearty concurrence of the respective departments; they were consequently more or less unsatisfactory to both sides. Even the present maneuvers met with resistances of various kinds, but the determination of the heads of the departments involved

*The author desires to state that this paper was prepared before he was directed to report to the Board of Arbitration for duty, and only at the request of the *U. S. Naval Institute* to present the present combined maneuvers *from a military point of view*. With that object he has treated the subject as a series of tactical problems, and discussed it from that standpoint. The views expressed are solely the author's, and he is not authorized to act for the War Department in any sense.

overcame them without any difficulty, and the Navy and Coast Artillery were thus enabled to profit by this valuable experience.

The importance of and the necessity for maneuvers result from a fact that is in reality a universal principle, namely, the tendency of the world to adhere to the mere *forms* and to lose sight of the *spirit* of ideas and things. So it was with drill: this tendency caused commanders to take the *forms* of barrack-square drill into the field, leaving its *spirit* behind, and the result was disaster. Thus arose the idea of making the drill more like actual field work, and this idea has gradually crystallized into the present so-called *maneuvers*, now recognized the world over as the highest means of training a navy or an army, in time of peace, for the work required of it in time of war.

The Navy and the Coast Artillery have this point in common, namely, their training of years may come into play but for a few brief moments, and this is far more true of the Coast Artillery than of the Navy, especially on a long coast line like our own, where, in view of the present short duration of wars, a portion only can come into play at all. It is evident, however, that for the very reason that their active service may be but for so short an interval of time, it is absolutely necessary that they be fully *prepared,* otherwise the time and energy spent on their training will have been wasted. No element of training, therefore, should be omitted, certainly not the highest element, maneuvers. The Navy can have maneuvers of fleet against fleet, or of fleet against forts, or finally combined operations involving the convoy and landings of large forces; but the Coast Artillery can be best taught and tested by being opposed to the attack of a fleet, as was the case in the maneuvers under consideration.

But maneuvers have an exceptional value for Coast Artillery due to several causes. In the first place, there is in the coast defenses a mass of complex machinery and material which can never be relied upon in action without first having undergone the test of service conditions, such as only maneuvers can apply. Again, the literature of this subject of coast defense is extremely limited, probably on account of the complexity of the problem and its infinite variety, due to the great influence of local conditions. Finally, there are but few instructive historical examples available for study and investigation, especially under truly modern conditions. The Coast Artillery is therefore compelled to rely almost

solely on maneuvers for its lessons of action and for the principles which are to govern in war.

The last three wars—the Chino-Japanese, the Spanish-American and the South African—if they have taught anything, have certainly impressed the thinking world with the necessity for maneuvers in time of peace, and that on a large scale. England's experience with her army has shown that maneuvers on too small a scale may be almost as dangerous as neglecting them altogether.

The prime object of such maneuvers is to *teach* practically the proper organization and administration of the troops for war, the most effective utilization of material and personnel, and the best tactics in action, but incidentally they also serve to *test* all these.

The Theater of Operations.

The theater of operations comprised the two Coast Artillery Districts of Narragansett and New London, extending along the Atlantic coast from Vineyard Haven, Martha's Vineyard, to the mouth of the Connecticut River. These two districts are related strategically in that they cover the entrance to Long Island Sound, and should constitute a single command under a general officer (in this case, of Coast Artillery), like any other strategic unit. There is no commander of this kind provided for by law, consequently the commanding officer of the Department of the East took command. In time of war, however, he would have other duties to attend to, and would not be available for this work.

The stretch of coast in this theater, with its series of fortifications, is practically the key to our great strategic point, New York City, from the East, and its main purpose is *defensive* in character, consequently the problem set for the Coast Artillery in the maneuvers was not only reasonable, but exactly to the purpose.

The most important strategic points are: (1) The Race, or the entrance to Long Island Sound, between Fisher's Island and Great Gull Island, south of New London, Connecticut; (2) Narragansett Bay, with its two channels of entrance, of which the Eastern Passage is by far the more important, since the Western has not sufficient depth, north of Dutch Island, to permit of the passage of the larger battleships and cruisers; (3) Martha's Vineyard, off the southern coast of Massachusetts; and (4) Block Island, off the southern coast of Rhode Island.

Beginning at the eastern end of the theater of operations, the

minor strategic points are: (1) Buzzards' Bay, with New Bedford, Massachusetts, as the principal town, just north of Martha's Vineyard; (2) Sakonnet River, a narrow entrance to Narragansett Bay, with about 4 fathoms depth of water; (3) Newport Bay, with the town of Newport, R. I., the Naval Torpedo Station, the Naval Training Station, and the Naval War College; (4) Point Judith, R. I., at the western side of the Western Passage to Narragansett Bay, and just north of Block Island; (5) Montauk Point, the eastern end of Long Island; (6) Fisher's Island Bay, between Fisher's Island and Connecticut, with Stonington as the principal town; (7) Fisher's Island, on the north side of The Race; (8) Great Gull Island, to the south of The Race; (9) Gardiner's Bay, between Gardiner's Island and Long Island; (10) Plum Island, west of Great Gull Island, also commanding The Race; and (11) New London, Connecticut.

The first objective of a hostile fleet intending to operate in this theater would probably be Nantucket Sound, east of Martha's Vineyard, or Vineyard Sound, to the north of it, to serve as a general base, and the next would be Block Island as a more immediate base for operations against either Coast Artillery District. The distance from Menemsha Bight, Martha's Vineyard, to New Harbor, Block Island, is about 38 nautical miles, which could be covered by a fleet (assuming a speed of 16 knots) in about 2⅜ hours. From Block Island to the Eastern Passage to Narragansett Bay is about 22.5 miles, requiring 1¼ hours, and from the same point to The Race is 22 miles, or 1⅜ hours. The passage from one district to the other direct requires 2⅛ hours. From Martha's Vineyard into Buzzards' Bay by the channel takes about 1¼ hours. Consequently with these two bases all points in the two districts could readily be threatened in one and the same night, the entire stretch of coast could be reconnoitered at the same time, and by early dawn the fleet could be assembled for attack on any point in the theater of operations.

Vineyard Sound has about 11 or 12 fathoms of water in the channel all the way from Vineyard Haven to Menemsha Bight; in Vineyard Haven itself there are from 6½ to 8½ fathoms, and in Menemsha Bight 8 to 10½. From the last-mentioned point around Vineyard Sound Light Vessel, well into Buzzards' Bay, 12 to 16 fathoms can readily be obtained; but from this point up the bay the depth rapidly reduces to 7½ fathoms, and on the way

to New Bedford the deepest channel beyond and to the east of Great Ledge has only 6 fathoms, which reduces to 5 before Clark Point is reached, but even into Clark's Cove (west of Clark Point) there is 3¼ fathoms. A hostile fleet can, therefore, move at full speed from its base on Martha's Vineyard well into Buzzards' Bay, although the channel is somewhat intricate within Great Ledge, and the heavier warships would have to pick their way towards New Bedford, and could hardly venture much further north than North Ledge with safety, while medium-sized warships could go a little past Clark Point on the east, but the smaller vessels could go to the west of the shoals, and run close in to the western shore, and on up into Clark's Cove, where there is still sufficient water for them.

The average depth from Vineyard Sound Light Vessel to the mouth of Sakonnet River is about 11 fathoms, and 3 miles up the Sakonnet River as much as 5 fathoms can be obtained; a narrow channel with a minimum of 3¼ fathoms runs all the way through to Narragansett Bay, with a railroad bridge at the northern end. West of the Sakonnet River are two bays, that between Easton Point and Ochre Point, called Easton Bay, having 6 fathoms off Ochre Point. The distance of Sakonnet River from Newport and the important naval and military stations there is about 5 miles (over 8500 yards), but Easton Bay affords a position within 4500 yards of the most distant of these points, although the high ridge (Cliff Walk) from Coggeshall Ledge to Easton Beach cuts off the view to a great extent.

The Eastern Passage into Narragansett Bay has sufficient depth for all classes of warships, and is at its narrowest point about 1600 yards wide, but it is not a straight channel, one of the turns being just within the entrance, and another about 4000 yards further in. The Western Passage, about the same width as the Eastern, has sufficient depth for the heaviest ships only to a point below the northern end of Conanicut Island, but ships requiring only 3½ fathoms can pass around the island and down the Eastern Channel, or up the bay to Providence.

From Point Judith to the northern point of Block Island is about 9 miles. The water area from this line to The Race is called Block Island Sound, a deep and quite unobstructed body of water, about 26 miles long and 77 miles wide in its widest part.

Between Fisher's Island and the mainland at Napatree Point,

south of Stonington, there are a number of rocks, reefs, bars and shoals, but near Sugar Reef is a channel with a minimum depth of 4 fathoms leading into Fisher's Island Sound, which itself has a minimum depth of 7 fathoms in the channel.

The Race, between Fisher's Island and Little Full Island, is very deep, especially near Fisher's Island, but in the center is Valiant Reef, where the water shoals to 3¼ fathoms over a small area. The distance from Fisher's Island to Great Gull Island (southwest of Little Gull Island) is about 5 miles, and to the middle point of The Race about 4300 yards.

Plum Island is about two miles west of Great Gull Island, and the channel between them is very narrow with only 5 fathoms depth. From Plum Island to The Race is about 8800 yards.

Between Plum Island and Oyster Pond Point, a projection from Long Island, runs Plum Gut, a narrow channel connecting Gardiner's Bay with Long Island Sound. Plum Gut is only 1400 yards wide from shore to shore, and the 7-fathom channel is rather narrow.

To the east of Gardiner's Bay is Gardiner's Island, the northern extremity of which, called Gardiner's Point, is 2¾ miles (5700 yards) from Plum Island, 6800 yards from Great Gull Island, and 6½ miles (11,500 yards) from The Race.

From Gardiner's Point to Montauk Point (the eastern extremity of Long Island) is nearly 14 miles. Block Island Sound is bordered on the south, between Montauk Point and Block Island (a distance of 12 miles) by a series of shoals, rocks and ledges, but with wide and deep channels between.

This is the general geography of the theater. The distance from Newport by sea to Boston is about 250 miles, from Newport to New London about 60 miles, and from New London through the Sound to New York City about 120 miles, and outside of Long Island about 180 miles.

The Problem.

The specific purpose of the maneuvers here discussed was to test the training of the personnel and the efficiency of the material, especially as regards the Coast Artillery, and the general problem was framed with this object in view. Incidentally, of course, like all other maneuvers, these were expected to *teach* as well as

to *test,* the principal lessons to be learned being those relating to problems of attack and defense of the coast, the determination of the most effective system of fire control and direction, and the details of organization and drill best adapted to the various conditions arising in active service.

The problem set was, therefore, as follows:

General Situation.

Anticipating the declaration of hostilities, a strong fleet (without torpedo-boats) determines to make a sudden dash upon Newport, or the eastern entrance of Long Island Sound, to secure a naval base, taking advantage of the absence of a declaration of war to find the land forces somewhat unprepared.

Special Problem.

For the Navy.—A naval base may be established at the discretion of the Commander-in-Chief of the naval force. The attacks by the fleet should embrace a day attack and a night attack, and if possible, a bombardment and a forcing of a passage.

The fleet will comprise:

Battleships.—Kearsarge, Alabama, Massachusetts, Indiana and Puritan.*

Armored Cruiser.—Brooklyn.

Protected Cruisers.—Olympia, Panther.*

Unprotected Cruisers.—Montgomery, Mayflower, Aileen.

Gunboats.—Gloucester,* Scorpion,* Peoria.*

Tenders.—Nina, Leyden.

Converted Merchant Steamer.—Supply.

For the Coast Artillery.—The districts of Narragansett and New London will be organized and prepared to resist the naval attacks. The latter being made before the declaration of war, it will be assumed that prior to the period of preparation (August 30, midnight, to August 31, midnight) no channels are mined or obstructed; thereafter (after August 29, midnight) mines and obstructions may be placed. There will be no floating defenses of any kind, and torpedo-boats are excluded.

The defense will consist of all the forts in the Artillery District of Narragansett (Forts Rodman, Adams, Wetherill and Greble)

*So rated for the maneuvers.

and in the Artillery District of New London (Forts Mansfield, Wright, Michie, Terry, and the fort on Gardiner's Point). They will be mobilized on a war basis, allowing two reliefs of artillerymen.

There will be no landing parties except on the Government or military reservations, but signal stations and outlying range-finding stations will be subject to capture by boats' crews.

Organization of the Forces.

Navy.

The fleet was under the command of Rear-Admiral Francis J. Higginson, and was organized as follows:

First Squadron.—Kearsarge, Massachusetts, Alabama, Indiana.

Second Squadron.—Brooklyn, Olympia, Montgomery, Mayflower.

First Reserve Squadron.—Panther (rated as a protected cruiser), Supply, Nina, Leyden.

Second Reserve Squadron.—Puritan (rated as a battleship), Aileen, Peoria.

Scouts.—Gloucester and Scorpion.

Collier.—Lebanon.

The Naval Militia was distributed as follows:

Kearsarge: Companies F and I, Massachusetts Naval Militia.

Indiana: 7 officers and 112 men, 1st Battalion, the 2d Separate Division (Rochester), and details from Engineer and Signal Divisions and Hospital Corps, 2d Battalion, New York Naval Militia.

Massachusetts: Engineer Division, Massachusetts Naval Militia.

Alabama: Companies G and H and part of Torpedo Division, Massachusetts Naval Militia.

Panther: Connecticut Naval Militia.

Brooklyn: Companies A and E, Massachusetts Naval Militia.

Olympia: Company B, Massachusetts Naval Militia.

Montgomery: 5 officers, 4 gun crews, and a detail from the Engineer Division, 1st Battalion, New York Naval Militia.

Aileen: 2d Battalion New York Naval Militia (entirely manned by the militia).

Coast Artillery.

The entire coast artillery was commanded by the Department Commander, Major-General Arthur MacArthur, with headquarters at Fort Trumbull, Conn.

District of Narragansett.

Colonel H. C. Hasbrouck, Artillery Corps, District Commander, with headquarters at Fort Adams, R. I.; Captain H. C. Schumm, Artillery Corps, District Adjutant.

Fort Greble, R. I.*—Major John McClellan, A. C., Fort and Fire Commander. Garrison: 72d, 109th, 45th and 103d Companies, Coast Artillery, and Batteries E, F and M, 1st Regiment Massachusetts Heavy Artillery.

Fort Wetherill, R. I.†—Major John A. Lundeen, A. C., Fort and Fire Commander. Garrison: 76th and 77th Companies, Coast Artillery, and a detachment of 20 men from Fort Adams, R. I.

Fort Adams, R. I.—Major John P. Wisser, A. C., Fort and Fire Commander. Garrison: 78th, 79th, 97th, 110th, 74th and 107th Companies, Coast Artillery, and Batteries G, H and L, 1st Massachusetts Heavy Artillery.

Fort Rodman, Mass.‡—Colonel James A. Frye, 1st Mass. Heavy Arty., Tactical Commander; 1st Lieutenant J. S. Johnston, A. C., Fire Commander. Garrison: Detachment of 21 men from 109th Company, Coast Artillery, and Batteries A, B, C, D, I and K, 1st Regt. Mass. Heavy Arty.

District of New London.

Lieutenant-Colonel J. M. K. Davis, Artillery Corps, District Commander, with headquarters at Fort Trumbull, Conn.; Captain John K. Cree, Artillery Corps, District Adjutant. For the maneuvers the District Commander's station was on Mt. Prospect, Fisher's Island.

Fort Trumbull (New London), Conn.—Garrison: 88th and 125th Companies, Coast Artillery.

Fort Mansfield § (Napatree Point), R. I.—Major L. H.

*On Dutch Island.

†At the Dumplings, near Jamestown, Conanicut Island.

‡South of New Bedford, Mass. Attached to Fort Greble, R. I.

§Subpost of Fort Trumbull.

Walker, A. C., Fire Commander. Garrison: Detachment of 36 men of 88th Company, Coast Artillery, the whole of the 46th Company, and part of the 82d Company, Coast Artillery.

Fort H. G. Wright (Fisher's Island), N. Y.—Major M. Crawford, A. C., Fire Commander. Garrison: 2d, 12th, 86th, 50th, 85th, 51st, 123d and 69th Companies, Coast Artillery, and Companies K and L, Engineer Battalion.

Fort Michie (Great Gull Island), N. Y.—Major H. A. Reed, A. C., Fire Commander. Garrison: also part of Company M, 3d Battalion Engineers, 125th Company, main part of the 82d Company, the 104th and 44th Companies, Coast Artillery and detachments of Engineer and Signal Corps.

Fort Terry (Plum Island), N. Y.—Major C. L. Best, A. C., Fire Commander. Garrison: 43d, 100th, 39th, 90th, 122d, 48th, and 35th Companies, Coast Artillery; part of Company M, 3d Engineer Battalion; the 1st and 2d Sea Coast Companies of Connecticut, a small detachment of the 1st Signal Corps of New York and a similar detachment of Connecticut Signal Corps.

Fort on Gardiner's Point (Gardiner's Island), N. Y.—Major A. Murray, A. C. Fort Commander. Garrison 54th Company, Coast Artillery.

Montauk Point (Long Island), N. Y.—Captain W. H. Coffin, A. C., commanding the 11th Battery, Field Artillery Siege battery. Only detachments from this battery, on duty at the signal stations were considered in the maneuvers.

Mines.

The mine-laying was under the direction of Major A. Murray, A. C. (commanding the Torpedo Station, now known as Fort Totten, N. Y.), with present headquarters Gardiner's Point during the maneuvers.

Obstructions in the channels were placed by the respective Engineer Officers of the two districts.

No mines were laid in the district of Narragansett, but obstructions were placed in minor localities.

In the district of New London mines were laid and obstructions were placed.

Service of Security and Information.

The service of security and information on shore was largely in the hands of the Signal Corps, but the horizontal-base stations

(at Fort Adams, for example) also furnished timely and valuable information, and the militia was utilized to complete this service. The Signal Corps used wireless telegraphy to a considerable extent. In the district of Narragansett the Marconi system was installed, with one station at Fort Wetherill and another on the summit of Beacon Hill, Block Island, besides the station on the scouting boat of the Signal Corps in this district. On the Long Island approaches the Fessenden system was installed, with the main station at Montauk Point and a second station on the scouting boat cruising between Montauk Point and Fisher's Island. At Fort Mansfield (south of Stonington, Conn.) the De Forest system was installed, with an outlying station on the scouting boat cruising between that point and Block Island.

Signal stations were established at all prominent points along the coast, including Wood's Hole, Mass. (on mainland opposite northern point of Martha's Vineyard, connected with the latter by cable), Gay Head (at the western extremity of Martha's Vineyard), Mishaum Point (on the mainland, north of Cuttyhunk Light), Sakonnet Point, Fort Wetherill, Beaver Tail, Point Judith, Beacon Hill (Block Island), Napatree Point, Mt. Prospect (Fisher's Island), near Fort Pond Bay, and at Montauk Point, Long Island.

The Conditions on the Two Sides.

Before proceeding to study the operations of the campaign and judging the relative efficiencies of the two services, the Navy and the Coast Artillery, a glance at the conditions on the two sides will not be out of place.

The Navy, having the *initiative,* the essential quality of the *attack,* which naturally falls to it in maneuvers against coast defenses, had, of course, a great advantage in being able to select its point of attack and the mode of conducting the operations, as well as the time, but this brought with it enormous strains on officers and men, who hardly rested during the entire period of the maneuvers. The Coast Artillery, on the other hand, although kept constantly on the alert, had periods of rest between operations, which were comparatively free from anxiety, because, while the fleet was actively engaged in one district no serious operations could be undertaken in the other.

Moreover, many of the officers of the fleet had been engaged in the recent fleet maneuvers and had not had time to recover fully from the demands made upon them in those strenuous days. The Coast Artillery, in that interval, had been quietly pursuing its daily routine work.

These are, however, only incidental disadvantages for the Navy, whereas those of the Coast Artillery are more general and permanent as a rule.

In the first place, the Navy is practically always on a war footing, that is, as regards such ships as are actually in commission at any particular time. Whereas the Coast Artillery, for various reasons, is never on a war footing in time of peace, and even in the late war was not perfectly so. Indeed, our Coast Artillery has not been on a war footing at any point for the past thirty years. In the present maneuvers several of the forts concerned (Rodman, Wetherill, Mansfield and Michie) had never before been garrisoned, so that the officers temporarily stationed there for the maneuvers were entirely unfamiliar with the geography of the region and the armament of the forts; moreover, the mechanics of the Ordnance Department were at work on many of the guns and carriages, repairing, improving and fitting with electric firing gear, up to the very day the maneuvers opened, thus preventing drill and leaving in the hands of the Artillery much practically new and untried material. The garrisons, even with the troops temporarily attached, were everywhere inadequate. The orders required two reliefs for each emplacement, but it was usually impossible to obtain *one* complete relief for any battery. With the present strength of the Coast Artillery company the following troops will be required to furnish two reliefs:

For every 12-in. B. L. R.,	1½	companies.
10-in. B. L. R.,	1	"
8-in. B. L. R.,	¾	"
12-in. B. L. M.,	⅔	"
6-in. R. F. gun,	½	"
15-pdr. R. F. gun,	½	"

Consequently, Fort Adams, for example, which had 6 companies for the maneuvers, should evidently have had 13, the 3 companies of militia being required to protect the horizontal-base stations and the reservation against landing parties. So it was at other posts.

There is another point of difference between the two services,

too. The Navy is perfectly familiar with our coast, particularly in these two districts, while the Coast Artillery is not sufficiently familiar with warships, mainly from lack of opportunity to study them. The coast is the Navy's natural subject of study, and this includes the coast forts, for the latter usually cover prospective naval bases, but the forts in these two districts are particularly well known to the Navy, because many naval officers have been stationed here at the Training Station, the Torpedo Station, or the War College, have studied the coast forts at the latter, and have for years been interested in the fortification of The Race, the portal to our greatest naval base, Long Island Sound. In consequence of this the Coast Artillery was tested far more severely during the maneuvers than it would be in actual war, for no foreign navy can be supposed to have the intimate knowledge of our coasts and forts that our own Navy possesses, nor would it concentrate *all* its efforts on one region.

Again, the main questions which arose in the operations of the maneuvers had been discussed at the Naval War College by class after class of officers. The Coast Artillery, unfortunately, had no War College, although one for the Army in general is being organized. The Artillery School does what it can in this direction, but with a one-year course and only young lieutenants under instruction little true *War College* work can be expected.

Finally, the Navy has had that highest of all practical experiences, actual war, and besides her two glorious victories, she had many problems to solve, and did solve them, relating to the very work that came into play in the maneuvers, and many of the officers in this mimic campaign had taken prominent part in the real one. The Coast Artillery, on the other hand, has not been engaged in action with its new coast armament, although during the war with Spain, it had the experience of preparing for such action.

The advantages of preparation and experience are therefore largely with the Navy, but for that very reason the Coast Artillery needs maneuvers to *learn* its lessons and to *test* its knowledge, and the better the teacher the more valuable the result.

Plans of Campaign.

The initiative in all such operations as those here involved is with the *attack*, with the Navy, and in deciding on the proper

mode of attack the entire theater of operations must be taken into consideration.

The western section, the District of New London, offers no safe base of operations not covered by the guns of the coast defenses. The north side of Montauk Point is the only sheltered locality in that section which could be seized and occupied without difficulty, but it could not be held, because it is connected by rail with New York City, and forces could be sent out promptly by land to prevent any fleet, unless accompanied by a strong force available on land, from gaining a permanent foothold.

In the eastern section, the District of Narragansett, there are a number of localities available as naval bases, but in order to secure such a base with some chance of effecting its capture by surprise the region selected for attack must be that in the vicinity of Nantucket Sound, probably either on Nantucket Island or Martha's Vineyard and not on the mainland, because the railroads there would enable the defense to concentrate rapidly: Wood's Hole being the terminus of one branch, and Stage Harbor. at the eastern end of the mainland, another. A base on Nantucket Island would be preferable as regards security, because Martha's Vineyard is too close to the Elizabeth Islands, and warships in Vineyard Haven and Menemsha Bight (only 15 miles in a direct line from Fort Rodman) would be subject to attack by torpedo-boats from that post, the islands affording a favorable screen for such operations, and the passages through them, particularly Quicks Hole, have sufficient water for the purpose. Edgartown Harbor, on the eastern end of Martha's Vineyard, is better protected against such torpedo-boat attack, but neither it nor Vineyard Haven have sufficient depth for the heavier battleships and the large cruisers. Menemsha Bight is deeper, and has also the advantage of being nearer to the objectives, namely, the defenses at Newport and The Race, but it is in dangerous proximity to Buzzards' Bay and Fort Rodman.

In the present maneuvers there were no torpedo-boats on either side, consequently it was safe to make Menemsha Bight (or Martha's Vineyard) the primary base of operations, but it may be assumed that in actual hostilities, in which each harbor would have its fleet of torpedo-boats, this base would have been selected farther east, as on Nantucket Island.

The secondary base would naturally be Block Island, with New

Harbor, on the west side, as the anchorage of the fleet. The position of Block Island is central, as regards the two districts concerned, and both objectives (Newport and The Race) are within easy reach. Of course, if the defense had its proper quota of torpedo-boats in Newport Bay the fleet in New Harbor, Block Island, only about 19 miles away, would be in a precarious position, unless it had a flotilla of destroyers to protect it. The torpedo-boats could move along the shore past Point Judith to Green Hill Point, directly north of New Harbor, possibly without being detected, and would then have but 7 miles to cover in a direct move against the fleet, a large part of which distance could be traversed unseen in foggy weather or at night. Moreover, New Harbor could hardly be used for any length of time because of its limited protection, since the larger ships would have to lie outside and in a spell of heavy weather this might prove disastrous; only the smaller vessels could run inside. This base would therefore serve only as a *temporary* base under those circumstances.

In the present maneuvers, since the defense had no mobile defenses whatever, Block Island could be used as a permanent base in fair weather.

From the two bases (Martha's Vineyard and Block Island) the fleet could readily move against the defenses in either Artillery District.

The Race, which is by far the more important and also the more vulnerable, would probably be the first object of attack. It is about 6.3 statute miles wide (between Forts Wright and Michie), consequently, in thick weather, especially at night, a fleet could run past at about 3 miles (over 5200 yards) from either fort. After passing, efforts could be made to take the emplacements of the different forts in reverse or enfilade. The smaller vessels (up to those which can pass through a channel with 3½ fathoms) could enter by the channel south of Gardiner's Island (after removing any obstructions that may have been placed there), and then move on through Plum Gut, and also attempt to reach a position out of gun-fire from the forts, where they could enfilade the latter or take them in reverse. Sugar Reef channel, east of Fisher's Island, is deeper, but in order to use it Fort Mansfield would have to be taken first.

This would appear to be the only feasible plan to attack The Race. It might be possible in thick weather to run between Fort

Terry and Gardiner's Point, then on through Plum Gut, but here the distance between forts is only about 3 miles, so that the middle point would only be about 2750 yards from either fort, which is very little more than half that at The Race.

The defenses of the eastern district, next in importance, must be considered as a whole, and naturally an outpost like Fort Rodman, especially one so near the principal base, and covering the entrance to Buzzards' Bay, an important anchorage for medium and light-draught vessels, would be attacked first. This can only be done by bombardment, the capture being then completed by landing parties.

Of the two channels leading into Narragansett Bay, the Eastern Passage is much the more important, on account of its depth, the Western not permitting the passage of the heaviest warships around the north end of Conanicut Island. But the Eastern Passage is comparatively narrow and the channel makes two turns before the forts are passed, consequently a forcing of the passage can hardly be attempted before the forts have been silenced or destroyed by bombardment.

With the vertical-base position-finders only in operation, two bombarding positions can be obtained: one near Brenton Reef Lightship, at the mouth of the channel, and another at Ochre Point, Easton Bay, east of Newport; but from the latter no direct view of the objective can be had, nor can the effect of fire be observed. With a horizontal-base range-finding system installed, however, neither of these positions is tenable.

On these considerations the plans of the fleet must be based.

The Coast Artillery, being forced to the purely defensive, can only take measures to protect its flanks, delay the fleet by means of obstructions under the fire of its guns, increase its field of fire to the utmost, and perfect its service of security and information.

In the District of New London obstructions can be placed in the minor channels, while torpedoes can only be laid advantageously in waters not deep nor with too swift a current. In the District of Narragansett the channels of approach to Fort Rodman can be obstructed and mined, and both entrances to Narragansett Bay could be mined.

The vertical-base position-finders are very generally limited in their field of view, or else they are so high that they offer con-

spicuous targets to the fleet, and finally they are not graduated beyond 10,000 yards as a rule. The limited field of view can, however, be readily enlarged by a proper horizontal-base system, and all the field of fire of guns and mortars be made available by this means, and the accuracy at long ranges much improved.

The service of security and information is largely in the hands of the Signal Corps, but may be supplemented and completed by the horizontal-base stations, and by the infantry garrisons placed along the shore adjacent to forts.

These are the factors that enter the plans for defense. The tactics applied under the various conditions of bombardment, reconnaissance, a run past, or a forcing of an entrance are general in character; the special applications under particular conditions will be referred to in describing the operations.

OPERATIONS.

September 1-6.

The fleet, under Admiral Higginson, rendezvoused in Menemsha Bight, Martha's Vineyard, by sundown, August 31, and was organized into squadrons as previously explained.

Securing a Base of Operations.

September 1.

The first object of the Admiral was to seize and secure his bases. For this purpose the Supply, Gloucester and Lebanon (collier) were despatched to Block Island after dark on the 31st of August, to anchor off the entrance to Great Salt Pond and to await the arrival of the fleet. The latter got under way at 10.40 p. m., heading to the westward.

Shortly after getting under way the Olympia was detached (with the Nina as tender) and sent to Gay Head, the western extremity of Martha's Vineyard, where she landed one company of Massachusetts Naval Militia, which occupied the signal station there, the latter having been previously abandoned by the Army signal men. She then proceeded to Wood's Hole (opposite the northern point of Martha's Vineyard) and cut all the cables connecting the latter with the mainland, after which the Olympia and Nina then anchored off Gay Head.

The fleet arrived at New Harbor, on the west side of Block Island, at dawn on the morning of September 1. The secondary batteries of the Brooklyn, Massachusetts, Indiana and Puritan shelled Beacon Hill (the Coast Artillery signal station), while the Alabama landed two companies of sailors, who captured the place. A sergeant and four signal men were taken, but one man escaped and sent messages by various means for several days after. The marines from the Kearsarge, Alabama, Massachusetts and Brooklyn were landed and established a camp under the fleet marine officer. The fleet anchored in New Harbor, the small vessels and collier inside Great Salt Pond.

A naval base having thus been secured on Block Island, the fleet held a position favorable for attack on any point of the lines of defense.

Under the circumstances existing in the maneuvers, this base could, of course, be readily held, but if Narragansett Bay had received its proper floating defenses, especially a torpedo flotilla such as every important harbor should possess, its close proximity would have afforded many opportunities for offensive action on the part of this flotilla, and the fleet would have had great difficulty in maintaining its position. Moreover, bad weather would have rendered the anchorage for the larger vessels very insecure and even dangerous.

Reconnaissance.

September 1.

The next movement was a reconnaissance of the front and flank of the lines of defense.

At 10 a. m., September 1, the Scorpion was despatched to reconnoiter the channel around the south end of Gardiner's Island, but she ran on an obstruction (a barge loaded with stone and sunk in the channel), and was consequently placed out of action for repairs, returning to Block Island before dark.

After dark on September 1 a scouting squadron, under the command of Commander Wilson, comprising the Panther, Supply, Montgomery and Mayflower, got under way and scouted the coast from Price's Neck, near Newport, to Fisher's Island. This squadron was sighted off Price's Neck at 12 o'clock midnight and fired on by the mortars at Fort Adams, by means of the

horizontal-base system of range-finding. The squadron, apparently, placed itself in the dead angle of the vertical-base system, not having any knowledge of the existence of the horizontal-base system established near Price's Neck, a supposition which is borne out by the fact that the squadron promptly retreated after the firing opened, and also by Admiral Higginson's report, in which he refers to "a signal and observation station at Price's Neck." The searchlight at Price's Neck did not reveal the character of the vessels, consequently they were fired on as if they were battleships. Two battery salvos (of 16 shots each) were fired at the leading ship, at ranges of 6925 and 7185 yards, respectively, and four battery salvos at the third vessel, or the one with the tallest masts and a headlight, at ranges of 7185, 7625, 9610 and 10,135 yards, respectively. The vessels could not be identified. These two vessels were, therefore, easily put out of action, and could not have proceeded with the reconnaissance of the coast, but the reconnaissance could, of course, be carried out by the other vessels. The fire from shore was not returned by the ships. The squadron proceeded on its way, locating all the searchlights along the coast to Fisher's Island, and then returned and anchored off Block Island about daylight.

Run Past through The Race.

Attack on Fort Terry and Gardiner's Point.

September 1-2.

Meanwhile, Admiral Higginson opened the more serious operations by a bold and determined attack on the right of the general defensive line at Fort Terry and Gardiner's Point.

At 9.00 p. m., September 1, the Brooklyn and Massachusetts left the base to run through The Race (Gull Island Passage) and take Fort Terry (Plum Island) in reverse. At 10.12 p. m. these vessels were sighted simultaneously by Forts Terry, Michie, Wright and Gardiner's Point, and the firing on them began at 10.15 p. m. from the mortars and the 10 and 12-in. guns of Forts Terry and Michie. The range from Fort Terry was about 4500 yards when first discovered. Both ships passed to a point about 3000 yards northwest of the flagstaff of Fort Terry and fired at that fort. Later, these vessels anchored beyond the field of fire

of the 10-in. guns, and inside the shortest mortar zone. The action ceased at 11.15 p. m.

At 1.40 a. m., September 2, the Kearsarge, Alabama, Indiana and Puritan got under way and proceeded to attack Fort Gardiner and Fort Terry from the other side. At 4.45 a. m. they were detected by the forts, moving in column in the order named, heading west-northwest, the Puritan some distance behind. The three leading ships fired at Fort Gardiner as they came in range, and soon silenced the 6-pdrs. there. Fort Terry opened fire on them at 5000 yards with all pieces (mortars and 10-inch). Meanwhile the Brooklyn and Massachusetts opened fire on Fort Terry. Two groups of mines were fired by judgment firing, and, it was claimed, put the Alabama out of action; and a few minutes later the Indiana struck a contact mine in crossing the line and was also put out of action. About an hour later the Puritan crossed the mine field and, it was claimed, was also put out of action by judgment firing.

The ships passed on, close in to Plum Island, and circled there firing on Forts Terry and Michie, taking the latter in reverse, and obtaining, in connection with the Brooklyn and Massachusetts, on the other side of Plum Island, a cross-fire on Fort Terry.

At 5.56 a. m. the ships passed eastward again, and moved on toward Block Island. The Brooklyn and Massachusetts, after engaging Forts Terry and Michie, joined the squadron on its return to the Base.

Had the weather favored the ships a little more, so as to enable them to cross the mine field with little loss, and also to approach closer to the forts before being discovered, the tactics of the Admiral would have been successful. They certainly brought out the weak points of the fortifications. The attack was splendidly conceived and executed, and shows a very accurate knowledge of our forts at The Race.

The two ships that ran through The Race suffered considerably from the fire of the forts, but it is probable that the battleship Massachusetts passed through in safety. On the mine field the Indiana was undoubtedly destroyed by a contact mine, but whether the judgment mines were effective in destroying the Alabama or Puritan is very doubtful.

Run Past through The Race.

Day Attack and Bombardment of Fort Wright.

September 3.

After the attempt on the forts at the extreme right of the general defensive line, and after giving directions for an attempt by a part of the fleet under Rear-Admiral Coghlan against the extreme left at the outpost Fort Rodman, Admiral Higginson, with the rest of the fleet, proceeded to complete the reduction of the defenses of The Race by making another run past, this time directing his efforts against Fort Wright on the north side.

Before beginning this action, however, the Leyden was sent out on the morning of the 2d of September to reconnoiter the channel south of Gardiner's Island. She surveyed a channel with 18 feet of water around the obstruction in the channel, and joined the fleet off Cerberus Shoal. No use was made of this information, but it is probable the Admiral contemplated drawing the attention of the forts from his real purpose, or actually intended making a diversion in that direction with his smaller vessels.

The movement against Fort Wright was similar to that against Fort Terry on the 1st of September, the object being to run in close and take rapidly a position out of the sectors of fire of the flat-trajectory guns, and within the minimum effective range of the mortars, with a view to enfilading or taking in reverse the emplacements.

To carry out this movement the Kearsarge, Alabama, Massachusetts and Indiana advanced against Fort Wright early in the morning, September 3, to steam close along the south face of the fort, then double around Race Point, taking the batteries in reverse.

The fleet had remained at Cerberus Shoal (between Fort Wright and Montauk Point) on the afternoon of the 2d, and the night of the 2d-3d. It was picked up by the searchlight at Fort Wright at 3.15 a.m., still at anchor. At 4.50 a.m. the fleet moved out heading northeast, moving well up beyond the eastern end of Fisher's Island, and then turned westward, coming along the south coast of Fisher's Island, well in toward shore. The tops and masts of the ships were plainly visible from Fort Wright position finder through the gap north of Mount Prospect, as they passed.

The ships had been discovered by Forts Wright and Michie, and at 5.10 a. m., at a range of 6500 yards from the former, were taken under fire by the mortars and guns of both forts. The ships passed through The Race along the entire front within 3000 yards of Fort Wright. The mortars fired twenty-four shots between 6500 and 3590 yards at the leading ship, the Kearsarge, beginning at 5.13 a. m. Then their fire was turned on the last ship, the Indiana. They were under the fire of the large and small-caliber guns of Fort Wright and the 12-inch battery of Fort Michie as soon as they rounded Mt. Prospect (at 4000 yards). The firing from the forts began at 5.13 a. m., and the ships were put out of action, according to the Fire Commander, in the following order by Fort Wright alone: Kearsarge, 5.20 a. m.; Massachusetts, 5.29 a. m.; Alabama, 5.30 a. m.; Indiana, 5.35 a. m. Since Fort Michie was firing at the same time, some of them were probably put out earlier. All were put out before reaching The Race.

The Fort Wright 12-in. and 6-in. batteries fired at every ship as she passed Mt. Prospect, but the fire of the 10-in. battery was limited by the 12-in. in the early part of the engagement, although it came into play later on.

On rounding Race Point the fleet turned to the eastward into the north channel, out of the field of fire of the flat-trajectory guns, and well within the minimum zone of mortar fire, where they reduced speed, and, forming single column, sailed back over the same course, firing as they repassed the batteries of the fort. The latter returned the fire from all available guns.

After this bombardment, the fleet having returned through The Race, anchored at the base on Block Island. At 6.40 a. m. the entire action was over, and the fleet was passing in column southward toward its base.

The splendid audacity of this action must appeal to every soldier, and as the Admiral was successful in getting within minimum mortar range before being discovered, he was able to pass the flat-trajectory guns with some chance of getting through with most of his force. But, as it was, there was plenty of time and opportunity (according to the District Commander) to put every ship out of action several times over, at least according to the rules of the maneuvers. Nevertheless, if such an attack had to be made (and the importance of The Race might easily war-

rant it), the attempt could not have been made in a more masterly way. The Coast Artillery officers were deeply impressed with the possibilities in the case, both by this action and that on the 1st against Fort Terry, and the bold tactics of Admiral Higginson will surely bear good fruit in the lessons taught.

In thick weather such a maneuver would have excellent chances of success, for then it would be mainly a question of the alertness of the garrison in detecting the fleet betimes, so as to get in a sufficient number of shots from the flat-trajectory guns.

It must be remembered, however, that even if the fleet should reach the position like that which it took up in this maneuver, the effect on the batteries, well covered and hidden as they are, would be very slight.

Bombardment of Fort Rodman.

September 3.

The attack on the District of Narragansett was opened by a bombardment of Fort Rodman, near New Bedford, Mass. A force, composed of the Brooklyn, Olympia, Puritan, Montgomery, Mayflower, Peoria, Aileen and Gloucester, under the command of Rear-Admiral Coghlan, was despatched during the night of the 2d of September, to make this attack. The Olympia picked up the company of Massachusetts Naval Militia at Gay Head before joining the fleet for the advance to the attack, which was opened about 7.30 or 8.00 a. m. on the morning of the 3d, the squadron having entered Buzzards' Bay some time during the night preceding, and came to anchor, the Puritan to the northeast of Penikse Island, and the rest of the ships off Cuttyhunk. At daylight the squadron, except the Puritan, got under way, and came up the bay, following the main ship channel until about off Mishaum Point, then turning more eastward, coming along about 9000 yards from Fort Rodman, the range reducing to 8900 at one point, then increasing again to 9600 yards, which was well out in the bay, and there the ships came to anchor, being joined by the Puritan after a delay of more than one hour. Fire was opened by the 8-inch guns at Fort Rodman at 9000 yards, and was continued while the squadron was at anchor and during its subsequent advance.

Before beginning this advance the following ships had been

put out of action: Brooklyn, Olympia, Montgomery, Mayflower and Gloucester.

After being joined by the Puritan, the squadron got under way, advancing in column, the Puritan (with the gunboats Peoria and Leyden a little in advance and about 800 yards to the right) leading, the Olympia, Brooklyn, Montgomery, Mayflower and Gloucester following in the order named.

It is not known when the Puritan (leading) opened fire, because sub-caliber ammunition was used in her main batteries, but the Brooklyn and Olympia opened with their main batteries at about 8000 yards.

At about 7000 yards the squadron divided, one division, comprising the Puritan, Olympia and Brooklyn, preceded by the Peoria and Leyden, taking the channel to the east of the chain of shoals extending from Great Ledge to North Ledge; the other division, composed of the Montgomery, Mayflower, Aileen and Gloucester, turned westward and, passing between Great Ledge and Dumpling Rocks, hugged the western shore, along the channel to the west of Brent's Ledge leading into Clark's Cove.

The 15-pdr. batteries of the fort opened fire at 6500 yards, and the left division of the squadron, as well as the secondary batteries of the right division opened at about the same range. During this final advance of the fleet the entire fire of the fort was concentrated on the Puritan, Peoria and Leyden, the 6-pdr. battery opening at 5000 yards, and the 1-pdrs. at 2500 yards.

The Puritan was put out of action about noon, the Peoria and Leyden about the same time.

The right division of the squadron continued to advance, the Peoria and Leyden removing the obstructions from the channel, until the leading ship was about 1000 yards from the fort, when they came to anchor and maintained a continuous rapid fire till the close of the action, at 12.15 p. m. The Brooklyn grounded just east of North Ledge at 11.43 a. m., having struck an uncharted rock. The Peoria remained with her as a tender and to assist in locating the obstruction.

Meanwhile, the left division continued to advance, and when the Montgomery (leading) was off Ricketson Point, the Aileen, which had not previously been sighted, came out from under the lee of the Montgomery and proceeded at full speed up the cove, getting out of the field of fire of all the guns before a shot was

fired at her. At the same time the Gloucester left her position at the rear of the column and passed at full speed to the left of the Mayflower and Montgomery, following the Aileen. The object of this movement was probably to take the emplacements in reverse and then effect a landing. The commander of the fort, to prevent the latter, sent the reserve detachment with one Gatling gun to the west shore. The Aileen proceeded up the cove and anchored after passing 400 yards beyond the reservation boundary; the other vessels of the division anchored about the same time; then all maintained a rapid fire until the close of the action, 12.15 p. m.

The squadron retired when the action was over, leaving the Brooklyn and Peoria behind. The rest of the squadron returned to the base on Block Island, the ships being reported to the Coast Artillery, in succession, from 2.45 to 4.40 p. m., by all the signal and range-finding stations from Sakonnet Point to Fort Greble, while on their way. At 9.10 a. m., September 4, the Brooklyn and Peoria left the vicinity of Fort Rodman, on their way to the naval base on Block Island.

Admiral Coghlan's attack was certainly enterprising, and was conducted with skill, judgment and dash, but it could hardly be carried out without the loss of all the vessels except the Puritan (rated as a battleship), and possibly the Brooklyn and the Olympia, and it is probable that the last two would also have been destroyed. The 8-in. B. L. R., with a muzzle velocity of 2300 foot-seconds, will perforate 3.38 inches of Harvey steel at 9000 yards, at the maximum angle of impact, 35°, at which penetration is possible (the most unfavorable angle), which would be more than sufficient to get through the Olympia's unprotected side or the Brooklyn's 3-inch belt, and at 8000 yards (at which range the ships opened fire with their main batteries) even the gun positions of the Olympia might have been destroyed (4½ — 3½ in.), although the gun positions of the Brooklyn (5½ — 8 in.) would not have been affected until at a range of about 4000 yards and less, consequently there was a possibility that the Brooklyn escaped, the fort having been silenced before this range was reached. The Puritan, assuming her to have the armor of the Kearsarge (9½ — 16½ in. belt) would probably not have been seriously injured by the 8-inch guns. All the rest of the fleet (that is, the smaller vessels) would have been destroyed, however,

and the Aileen's well-executed maneuver would not have been possible, for she would not have had the Montgomery to hide behind, that vessel having been destroyed before the final advance of the fleet began. An attack of this kind would not be made as a rule, but if the objective had some strategical or tactical importance it might become necessary to do it. In that case the squadron would not, however, lie at anchor within range of the fort guns (9000 yards) for an hour or more. This part of the Admiral's action cannot be explained unless the Admiral assumed his fleet to be at a greater range than was actually the case, for the Fire Commander at Fort Rodman need not have made any serious error in range since all his data from the range-finder could readily be checked by the innumerable land and water marks in this land-locked bay.

By keeping his squadron beyond 11,000 yards, and the smaller vessels even farther out until the heavier ships' guns had silenced the coast guns, and then advancing in the way the squadron actually did advance, the attack would have had better chances of being successful, *without mines in the channels.* Such a direct attack would probably not be made, however, in time of war, and the maneuver was no doubt intended to test the Coast Artillery men and materials, and not designed to be a real tactical maneuver.

Run Past the Forts at The Race.

Night Attack and Bombardment of Fort Wright.

September 4-5.

The Admiral next attempted to run past the forts at The Race by taking advantage of thick weather, and employing the ruse of preceding his battleships at some distance by two cruisers to draw the fire and the attention of the guns on shore and to destroy the searchlights.

On the morning of the 4th the weather was thick and everything seemed propitious for a run through The Race, consequently at about 4 a. m. the Kearsarge, Alabama and Massachusetts got under way and stood for The Race for this purpose, but the weather cleared, and they turned northward and eastward toward Newport. They turned back, however, to the base, where they were joined by the Indiana. They kept under way the rest of

the day, thus keeping the two districts in suspense as to the next move and point of attack. The Indiana anchored at the base before dark.

After dark the run was attempted, the Brooklyn and Olympia leading, with the Kearsarge, Alabama and Massachusetts about a mile behind. The two cruisers directed their fire on the searchlights, with a view to putting them out as well as to draw their beams to themselves and thus allow the battleships to get as close as possible without being discovered.

At 9.10 p. m. the movement was discovered by Fort Wright, when the ships were still far out of range. At 10.04 p. m. the range of the leading ship was 8000 yards from Fort Wright, at 10.07 the action commenced at Fort Wright and the ships began to reply at 10.10. Fort Michie discovered the Brooklyn soon after 10.06 p. m. at 5375 yards range from that point, and opened fire with all batteries. Fort Terry also fired at long range. The cruisers threw their searchlights in the direction of Fort Wright, and at 10.20 p. m. passed The Race. Seventeen minutes later, at 10.37 p. m., the battleships were discovered by the searchlights of Fort Wright. All batteries fired at all ships, those of Fort Wright at ranges varying from 3000 to 6000 yards, the others at larger ranges, until 11.10, when the ships were out of range. The ships ran into Long Island Sound and at 1.00 a. m., September 5, anchored off Horton's Point, Long Island.

The Admiral's ruse appears to have been fairly successful, for the battleships were not discovered until 10.37, and at 10.45 they passed The Race, or 8 minutes short of that point of time when discovered, consequently, assuming the fleet to move at a 16-knot speed, they must have been within 4500 yards of Fort Wright when first seen.

The cruisers probably put out the shore searchlights before they themselves were destroyed, but even if that had been the case the battleships would have suffered severely, because they would have been seen without searchlights. The night was a perfectly clear starlight night, and would not have been selected for such an undertaking, as the Admiral himself admits. In a foggy night, or in cloudy and thick weather, the run past could probably be effected without difficulty, as it usually can in a channel sufficiently wide and deep, but not without sacrificing a part of the fleet. This was the last night available for this work,

because the next was the last of the maneuvers and had to be devoted to the other district, so that the Admiral could not wait for a more favorable opportunity. Considering what his brilliant tactics accomplished in a clear night, it is but fair to assume that in a thick one he would have succeeded better.

Attack on Montauk Point.

September 4.

At Montauk Point were located two very important signal stations of the Coast Artillery, one at Montauk Point Light, the other 4 miles back, between Fort Pond and Great Pond. A battery of field artillery (Captain Coffin's, on practice march from Fort Hamilton) had been directed to give assistance to the signal stations, and had consequently detached all its cannoneers to the two stations, each receiving 1 officer and 17 men, armed with revolvers. These detachments were carefully intrenched in their respective positions.

The drivers, animals, guns and train were assembled in a *neutral* camp, about 8 miles west from the light, and had nothing to do with the maneuvers.

On the morning of the 4th, an expedition composed of the Panther, Scorpion and Supply, under Commander Wilson, was sent from the fleet to attack this place. At 5 a.m., September 4, the Panther appeared in Fort Pond Bay, followed by the Scorpion and Supply. These vessels had been observed from shore, moving about outside, but as they were off the camp, where nothing concerned with the maneuvers was located, no special notice was taken of them.

At 5.30 a.m. the ships bombarded the shore line and the camp of the field battery for about 3 hours. When informed that the camp was neutral they moved towards the signal station and devoted their attention to that, landing, at 8.40 a.m., ten boatloads of Connecticut Naval Militia (300 men) to attack the signal station. They captured the station 4 miles back from the light, but retired to the ships after that and made no effort to take the station at the light itself. The squadron remained in the vicinity till the afternoon of the 5th, when it was ordered to withdraw, the Scorpion rejoining the fleet.

The bombardment, the landing and the land attack were some-

what faulty. The vessels came in broadside on to the hills, where any troops defending the shore would have been, of course, and fired only at the beach, where no troops would probably have remained; the landing was slow; and the attack on the station was also open to criticism, for the men and officers took no advantage of cover, although there was plenty available, and when close up to the station, the bugle sounded *by the right flank,* which was executed, while the attack ceased firing. In all three phases, bombardment, landing and attack, the entire force could easily have been destroyed had there been a suitable force available for the purpose.

Day Attack and Bombardment of Forts Adams and Wetherill.

September 5.

At 5.00 a. m., September 5, the fleet, off Horton's Point, Long Island, got under way again and proceeded to a place off Newport, where the ships rendezvoused for the next operation: a bombardment of the defenses of the Eastern Passage, Narragansett Bay.

The Admiral's plan of attack was to anchor the Massachusetts, Indiana and Puritan off Ochre Point, and shell Forts Adams and Wetherill over the land, thus enfilading Fort Wetherill and taking Fort Adams in reverse; while the Brooklyn, Olympia, Alabama and Kearsarge were to zig-zag in a *supposed* dead-angle of direct gun fire from Forts Adams, Wetherill and Greble, inside of Brenton Reef Lightship, and bombard Forts Adams and Wetherill directly.

The movements of the fleet were constantly being reported to the Fire Commanders through the signal stations at Point Judith and Beaver Tail, and by the horizontal-base station at Price's Neck. At 10.52 a. m. these reports began to indicate an advance on Newport, the fleet then heading for Point Judith, about 5 miles out from there; at noon the ships were identified, but stationary; and at two o'clock in the afternoon they were reported under way again.

Immediately after, the Indiana, Massachusetts and Puritan left the squadron and headed due east; this was also observed and reported.

All the forts in the bay were therefore fully prepared for this attack.

The fleet had been lying about 11 miles southeast of Price's Neck, and came in heading for the Eastern Passage (the Brooklyn, Olympia and some of the smaller vessels leading), but when about 6 miles south of Price's Neck the Brooklyn and Olympia turned westward towards Narragansett Pier, while the Montgomery, Mayflower and Scorpion (the last some distance behind) headed for Price's Neck.

The Brooklyn and Olympia attacked the signal station near Narragansett Pier, and put it out of action in twenty minutes, shelling from the secondary batteries. The Kearsarge and Alabama, steaming slowly behind, kept straight on to a point about 3 miles south of Price's Neck, where they moved in a small circle and bombarded the forts. Meanwhile the Brooklyn and Olympia also took up a position, about a mile or so directly south of Whale Rock (Western Passage) anchored, and bombarded. The entire fleet was under continual observation from the horizontal-base stations at Price's Neck, Brenton Point and Castle Hill, and at 2.20 p. m. the Brooklyn and Olympia were observed by Fort Greble at a range of 10,700 yards from that point, and the mortars and 10-inch guns there opened fire on them. About the same time three of the smaller vessels, the Montgomery, Mayflower and Scorpion, headed for Price's Neck, coming in full speed, and Captain Coe (in charge of the horizontal-base system), opened fire with the mortars, first on the Montgomery, then on the Mayflower, the former being put out of action at 2.41 p. m., the latter at 2.47 p. m., the range being about 9000 yards from the mortars at Fort Adams.

The Kearsarge being now within range of the mortars at Fort Adams was next fired at by the horizontal-base system, but when the Scorpion came within range (she remained stationary for a time some distance behind the Mayflower) a battery salvo was fired on her, putting her out at 3.09.30 p. m.

The mortar battery at Fort Greble fired one salvo at the Brooklyn as she approached. Then, at about 3.16 p. m., the Brooklyn and Olympia came to anchor at a range of 10,285 yards from Fort Greble and 9825 yards from Fort Wetherill, and began bombarding the forts in the Eastern Passage. Fort Wetherill opened fire with its 12-inch guns at 3.16 p. m., at the Brooklyn, Olympia, Kearsarge and Alabama in succession.

Captain Mauldin, in charge of the vertical-base position-finder

of the Fort Adams mortars, seeing the Montgomery firing at Price's Neck, and fearing that the station there would be declared out of action, opened fire from his station at 3.09 p. m., first on the Kearsarge, then on the Alabama, both vessels being within the field of view of that station.

Meanwhile, Fort Greble fired in succession on the Brooklyn, Kearsarge, Olympia and Alabama, with its mortars and 10-inch guns.

The ranges from Forts Adams and Wetherill varied from 7400 to 9800 yards.

The ships were put out of action (considering the fire of all three forts) at about the following times:

Montgomery	2.41 p. m.
Mayflower	2.47
Scorpion	3.09.30
Kearsarge	3.11.58
Brooklyn	3.18
Alabama	3.21.47
Olympia	3.23

Meanwhile, the Montgomery, Mayflower and Scorpion stood in toward Price's Neck. At 3.30 p. m. that station was attacked by boats' crews (about 46 men) sent ashore from the Montgomery, but this station was well protected by 20 men of the First Massachusetts Heavy Artillery intrenched at the station, with 2 Gatling guns, and about 50 men of the same regiment flanking the road leading to the station. The attacking force was therefore captured or destroyed.

While this action was taking place at the mouth of the Eastern Passage, the Massachusetts, Indiana and Puritan, anchored off Ochre Point, in Easton Bay, fired on Forts Adams and Wetherill overland, the object being to enfilade Fort Wetherill and take Fort Adams in reverse. Neither fort was visible from the position of these ships, consequently the effect of this bombardment was not decisive.

The Admiral, in his report, speaks of a *dead angle* of the flat-trajectory guns inside the Brenton Reef Lightship, but there is no such dead angle, as this area is visible from the vertical-base position-finder at Fort Wetherill, and from the 12-inch guns themselves, but in order to insure a better view farther to the left of

the Lightship, the Fire Commander had established a horizontal-base system at Fort Wetherill. The ships did not go inside of the Lightship on account of the danger of striking uncharted rocks, but even if they had they would have been under fire quite as well as they were, except perhaps from the guns at Fort Greble. The field referred to was, moreover, perfectly covered by the horizontal-base system for the mortars at Fort Adams. As it was, the ships were under fire from all the high-angle and flat-trajectory pieces of all three forts, with the exception of the 10-inch and the rapid-fire guns at Fort Adams, which are not intended to cover that section.

At Easton Bay a horizontal-base system for the mortars at Fort Adams had also been established and oriented, but the Signal Department decided that they could not maintain so long a line of communications in working order; had it been completed it would have effectually prevented the bombardment from Ochre Point.

The bombardment ended at 4.57 p. m., the ships retiring toward the base on Block Island.

The ships returning from Ochre Point came within the range of the mortars at Fort Adams, and were taken under fire by the horizontal-base system at Price's Neck. The Massachusetts and Indiana were both put out of action, the former at 5.43.19 p. m., the latter at 5.56.10 p. m. Consequently, the entire fleet, with the exception of the Puritan, was destroyed in this action. It is but fair to state, however, that the ships returning from Ochre Point probably considered the phase ended when they left their position there.

Run Past the Batteries in the Eastern Passage, Narragansett Bay.

Night Attack on Forts Adams and Wetherill.

September 5-6.

The decisive action in the District of Narragansett was a forcing of the Eastern Passage to Narragansett Bay.

To prepare for this movement, the Peoria and a sailing launch were sent on the night of the 4th of September, to clear the channels at Newport by dragging and countermining. After dragging half-way across the western channel, the guns at Fort Greble opened fire on them, but they continued their work, after which

they entered the eastern channel and planted countermines with buoys to mark the line of mines.

This vessel was under observation from 8.35 p. m., when she was first reported to the Fire Commander of Fort Adams, as having extinguished lights in approaching the harbor; at 10.39 p. m. she was again reported still outside, and at midnight the searchlight at Fort Greble picked her up at about 10,000 yards range, but the fort did not open fire until 12.30 a. m., September 5, when she was about 6300 yards out. The fort opened with the 10-inch guns and the 15-pdrs., putting her out of action at 12.53 a. m., but continuing to fire on her for over fifty shots, at an average range of 4000 yards. She was reported out of action to the Fire Commander at Fort Adams. She remained in the western channel until 3.30 a. m., when she rounded Beaver Tail, being at once observed by the Fire Commander at Fort Adams, who kept his light on her and followed her in. As she approached the rocks off Fort Wetherill she turned on her lights, which had been out until then. No work going on was visible under the searchlight, and she had no guns aboard, consequently the Fire Commander at Fort Adams did not fire on her, particularly as he knew that there were no mines planted in the channel and feared that the small supply of blank ammunition on hand for the maneuvers might give out in the decisive actions yet to come for this district, and therefore did not wish to waste any.

The Peoria was undoubtedly destroyed in the western channel, and consequently was no longer available for this work in the eastern, and, although no mines were planted, the fact that she could inform the Admiral that the channel was clear was all the information he wanted to send his ships in at good speed, which otherwise he might have hesitated to do.

The night attack came somewhat unexpectedly, although Fort Greble reported the warships maneuvering around Beaver Tail as early as 7.42 p. m., and the signal station at Beaver Tail reported them soon after as having put out their lights, and at 9.03 p. m. as coming nearer. At 9.30 p. m. the signal station at Point Judith reported the fleet as heading for Newport.

The Fire Commander at Fort Adams remained at the range-finder, but expected to be further informed of the movements of the fleet, before it could arrive within the field of view of his telescope either from the horizontal-base stations at Price's Neck,

Brenton Point and Castle Hill, or from the range-finder at Fort Wetherill, all of which could see much farther out to sea. At about 10 o'clock, however, he suddenly saw the stacks of the Brooklyn to the left of Castle Hill, at about 4500 yards range, and immediately after Fort Wetherill reported seeing them. That they were not sooner discovered can only be accounted for by the fact that the searchlight at Fort Wetherill was kept perfectly still in a fixed position directed on the eastern side of the entrance inside the Lightship; it thus cut off the view both of the searchlight at Price's Neck and that at Fort Adams, and the fleet, with lights well boxed, was able to run in on the dark ray bordering the beam. The ships passed within 11,000 yards of Fort Greble, too, and had the Fort Wetherill light been in motion slowly covering its available sector from inside of Brenton Reef Lightship over to Beaver Tail, it is quite possible that Fort Greble would have been able to see the ships in its ray. The lights bearing on the open sea were all apparently too small.

The fleet entered in single column at a speed of about 12 knots, but did not fire until well in, probably on account of the danger from smoke, which might have caused collisions. The Brooklyn led, followed by the Olympia, Kearsarge, Alabama and Massachusetts, in the order mentioned. The Montgomery had sailed for New York, and the other ships had returned to the base.

Fort Wetherill opened fire with the 12-inch guns at about 10.00 p. m., Fort Adams with the 10-inch guns at 10.05.30 (the moment the leading vessel came into the sector of fire of this battery), while Fort Greble could only fire at the ships through Mackerel Cove, beginning at 10.08 p. m., using both mortars and 10-inch guns. As the vessels came within the proper range the rapid-fire batteries at Forts Adams and Wetherill also opened. The fleet did not begin firing until after the Brooklyn and Olympia had both been put out of action. The searchlights of the ships were directed principally on an obsolete emplacement north of the rapid-fire battery, and at no time interfered in the least with the work of any range-finder.

The ships were probably put out of action at the following times:

Brooklyn	10.02.30 p. m.
Olympia	10.08.30
Kearsarge	10.14.30
Alabama	10.18.30
Massachusetts	10.21.30

The fleet passed in to the west of Rose Island, then around Gould Island, and out again to sea, anchoring at the base. Fort Adams fired on the ships going out, but Fort Wetherill was silent, and the fleet did not return the fire.

This ended the action.

The attack on Forts Adams and Wetherill was also made, no doubt, to test the material and personnel of the forts, and was in no sense a true tactical maneuver.

There were no further operations, and the maneuver period ended at noon, September 6.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE ARMY AND NAVY MANEUVERS AS VIEWED FROM AFLOAT.

By Lieutenant-Commander Roy C. Smith, U. S. N.

The writer of this article does not propose to describe the maneuvers. Accompanying the paper is Admiral Higginson's Bulletin giving a summary of the movements of the fleet, and a sketch-map showing the approximate paths of the ships in the more important engagements. The rules for the maneuvers were published in the Professional Notes of No. 103 of Proceedings of the Naval Institute.

There was, however, among the officers taking part afloat a consensus of opinion on various points that came up, which may prove of interest to readers of the Institute; and it shall be the endeavor of the writer to summarize these views to the extent that they became apparent to him.

The rules were criticized in a number of particulars by officers of both services. Prior to the maneuvers the two officers who had prepared the rules, under the direction of General MacArthur and Admiral Higginson, met the umpires and observers to talk over the subject and settle any doubtful points. At this conference the discussion turned about three principal questions. One was whether the life of the defensive works had not been somewhat underestimated, another was as to the course of proceedure in the event of disputes of umpires in the few cases where under the rules decisions were required, and another was as to whether it was advisable to assign any values to gunfire and the life of ships and forts. The discussion was amicable, and of course it was too late to make any changes, but one of the officers present remarked that had the Lord's Prayer been up for discussion it would not have fared any better.

In regard to the questions mentioned, it is pertinent to state that they had been considered by the officers who formulated the rules. The War College staff had, unofficially, rather deprecated assigning values to gunfire or the life of ships and forts. Their argument was that it would result in laying down all the moves on the game board and counting points, rather than in acting in accordance with judgment and as circumstances should dictate. This would have been in a sense objectionable; still any commander planning an attack would naturally count up the opposing forces and estimate how long he would be under fire, and would endeavor to form in his mind some estimate of the damage to be expected. Also, one of the features of the maneuvers was that no units were to be declared out of action during any engagement, but for the sake of the training and experience were to continue through to the end, the Board of Arbitration deciding finally as to the outcome.

Hence some method was required by which a responsible commander could estimate approximately when to cease his fire on certain ships or batteries and then turn his attention to other units as they arrived in his field. Some such assignment of values would have to be made use of by the Board of Arbitration in arriving at their conclusions, and it seemed fair that if it was to be used at all it might as well be public to everybody.

One of the other questions related to the accuracy of the assigned values. No artificial rules could replace actuality. The most that could be done was to devise a method of approximating average values in these, the first combined maneuvers, and then to correct the values in the light of the experience gained. Quoting from an article by the writer in the New York Independent, the method was something as follows: "A battleship was given arbitrarily a life of 1000 points. It was assumed that one or two 12-inch shells loaded with maximite and penetrating her vitals would put her out of action. Then from the accuracy of fire at different ranges and the angle of fall, the number of shots was estimated that would have to be fired to get two into the vitals of the ship. The quotient of 1000 by this number was the value of each shot of a 12-inch army gun at the stated range. And so for other guns and other ships than battleships. The points for the navy guns followed in this wise. At close ranges their accuracy is practically the same as for the

corresponding army guns. At extreme ranges, owing to the instability of the gun platforms, and the circumstances that there are no accurate means supplied aboard ship of getting the range, as there are on shore, the percentage of hits will fall considerably below that of the army guns at the same range. This is not a criticism of the ship. Ships are meant to fight each other at ranges close enough to produce results. Then the size of the vulnerable target, whether battery, or position-finder or searchlight, as affected by the angle of fall of the projectile, and as compared with the average target presented by a battleship, and the damage done by one hit of a given caliber, determined the points to be assigned to each caliber for each range, and the life in points of each object fired at. It is to be understood that the points assigned the army and navy guns at the various ranges were in no sense a comparison of the guns themselves. The points had nothing to do with the relative power of the guns, but were the estimated effect of their fire in points *against the life of their own targets*. There was also established a rate of fire per minute supposed to be adequate to silence temporarily the batteries on shore and the exposed guns of the ships."

While on the subject of the rules it may be as well to indicate the changes which, in the opinion of the writer, the experience of the maneuvers showed to be desirable. It would be well to limit the effect of the lighter caliber fire to silencing only, and not to count it at all against the ultimate life of the various targets. Under the rules it counted against the life of ships and batteries when used in co-operation with higher calibers (Rule 59). It would be better not to count it at all except in silencing. The total points from a 6-pounder at 500 yards are 200 per minute, whereas from a 13-inch gun they are only 100 per minute. Hence a 6-pounder would have more effect against a defensive work, both firing together, than a 13-inch gun, an anomaly that may be corrected in the manner suggested; that is, count the 6-pounder only in silencing, the 13-inch gun both in silencing and destroying.

The searchlights and position-finder towers were found to be much more conspicuous than the rules seemed to contemplate, hence their life in points would apparently need to be diminished.

Some ambiguity seemed to exist as to the limits of phases in the various operations. As no ships or forts were to be ruled

out during the maneuvers, the navy tacitly assumed that their whole force was available for any attack that might be made; whereas the army apparently assumed that certain ships had been destroyed in earlier phases and hence were negligible in later phases. It would be well hereafter to make the meaning perfectly clear in this regard and to adopt some readily understood signal to indicate the beginning of a new phase. Rule 57, in reference to attacks on intrenched positions, contemplated shore operations only, and not landing parties supported by the fire of ships. The following sentences might be added: "In the case of an attack by a landing force supported by the fire of ships, the advantage in favor of the defense shall be reduced, or reversed, in such manner as the umpires may decide to be reasonable. In case of a failure to agree, the circumstances shall be referred to the Board of Arbitration."

It was suggested, and it is to be hoped that the suggestion was accepted, that the Board of Arbitration amend the rules in the light of all the various reports, and thus leave on record a basis to start with in case something similar has to be done in the future; in other words to thresh out something practicable by the trial and error method. One of our navy faults is to try nearly everything *ab ovo*, instead of gradually building up a method in particular cases that shall be in course of time at least partially self-working.

In arriving at any useful results in maneuvers of this kind, it must be borne in mind that they are games only, and are designed to bring out particular features of attack and defense. In the maneuvers in question, the object was primarily to afford practice to the personnel, secondarily to test the matériel in as far as the simulated conditions should permit. The character of the test was practically limited to discovering the target, determining its range and bearing, transmitting these to the gunners, and going through the motions of loading, pointing and firing. As such, the practice was eminently useful and satisfactory. The question of who won hardly enters at all. It was natural that some defects should have been brought to light, or at least made more prominent, and this feature in itself is a most valuable result of the maneuvers.

Some of the operations may now be taken up in order, and such comments made as may seem applicable. The first move-

ment of the fleet was to secure a base from which attacks could easily be made on any part of the line of defense. Block Island proved convenient for this purpose. In actual war it would perhaps have proved useless and untenable. There is no shelter from the weather, and no possibility of defense against torpedo attack. As it was summer, and the army was not provided with any floating defense whatever, the position met the requirements of the occasion sufficiently well.

The first attack was a combined movement on Forts Michie and Terry. The Brooklyn and Massachusetts led in in the evening, the Kearsarge, Alabama, Indiana, and Puritan coming up on the opposite side in the early morning. Of course, the question to be settled is as to the fate of the first two. They laid a course to pass between Little Gull Island and Valiant Rock, and had got in to fairly close range before they were discovered. The searchlights did not seem to be of great assistance to the defense, as the beams were on the ships many times, fitfully; and when their final concentration showed that the ships were really made out, the range was pretty close, about 5000 yards. Had the ships been dull war color instead of glossy white, this distance would no doubt have been less. The course lay within 2700 yards of the batteries of Fort Michie, and the ships were some 15 minutes under the heaviest part of the fire. If they survived this punishment, their eventual position gave them command of the batteries in reverse. It is probable that there should be no reverse for batteries in such locations. In case of an attack in force, or at night, or in a fog, some of the ships would be reasonably certain to get through, though the others might be sunk, and once in rear, the batteries would be at their mercy.

The vertical base position-finder towers seemed exceedingly conspicuous. The light batteries of the ships were directed on these and on the searchlights, and must have disabled them early in the action. It is true that at such close ranges, direct sighting would have been used anyway, and the destruction of the towers would not have been of so great consequence. Still the towers are prominent marks at all ranges, and are good reference points for the batteries.

The ships coming up in the early morning were fairly close to Gardiner's Point before they were sighted. One of them

ran on a contact mine and was put out of action. Two of the others were in the neighborhood of observation mines that were fired by judgment from shore, though it is not certain that both cross-range bearings were observed together. This mine field was a surprise to the ships. It was supposed that Plum Gut would be mined, but it is obvious that a line extending between Gardiner's Point and Great Gull Island will be equally effective, and though requiring more mines, it is not subject to strong tidal curents. After these ships had circled about for awhile in face of Fort Terry, while the Brooklyn and Massachusetts established a cross fire from the other side, all the ships finally withdrew as they had approached.

Fort Rodman at New Bedford is not really in the strategic district of the attack. Still, to give practice to all the personnel, a division under Admiral Coghlan was sent to engage these batteries. Light vessels preceded the heavy ones to develop possible mines and obstructions, and the final attack was made at anchor. The Brooklyn in coming out struck an uncharted pinnacle rock in the middle of the main channel. The rock has since been located and buoyed. The accident points to the grave necessity of careful resurveys of many of our coast channels and harbors.

The other principal operations were day and night attacks on Fort Wright and on the Newport defenses. The day attack on Fort Wright began by the battleships coming up before dawn under cover of Mount Prospect—the hill on the point of land just to the eastward of the batteries—and in the dead angle of direct gunfire. They were within mortar range, but it is doubtful if the range stations covered that part of the approach. After they rounded Mount Prospect, it was a close cannonade on both sides all along the front of the batteries, through the Race, and up to the northward, taking the works in reverse. The tactics of the approach in this case was distinctly good. It probably got the ships through the mortar zone without damage. After that it was a contest of strength, ending at the Race. If the ships were still afloat, the victory was theirs, for the batteries were helpless to the westward. The same comment applies as in the case of Forts Michie and Terry; there ought not to be any reverse.

The night attack on Fort Wright was simpiy a run-past.

The Brooklyn and Olympia went ahead to make a diversion, while the battleships endeavored to get into close range undiscovered. The fire of the leading ships was directed entirely at the searchlights and observation towers, to pave the way for the real attack. The cruisers were probably sacrificed. The battleships got within 5000 yards before they were discovered, and went through with a favoring tide at 15 knots over the ground. They probably got through successfully, as they were not more than 10 minutes under fire.

The last day was devoted to the Newport defenses. There was a general bombardment in the afternoon and a forced entrance at night. The main channel had been countermined by the Peoria the previous night, as a cautionary measure, though, as it turned out, it had not been mined. The Peoria had been under fire for a short time while dragging the western channel, and had subsequently exploded her dummy countermines in the eastern channel without interference. Some question arose as to whether the two operations should be counted as a single phase, but the fact seems to be that her mission in the eastern channel was not recognized.

The bombardment was preceded by an attack on the signal and position-finder stations by the cruiser squadron. After this had proceeded for a reasonable time the Kearsarge and Alabama ran in near the Brenton Reef lightship, intending to gain a position in the dead angle of direct gunfire from all the forts. The exact position was not occupied, for though sufficient water is shown on the charts, it is not a fair way and there was a risk of running on unknown rocks. In their actual position the ships were under fire of most of the guns and mortars, though in a real war the risk would have been assumed of occupying the actual dead space, notwithstanding possible rocks.

Another division, consisting of the Massachusetts, Indiana and Puritan, came up from the eastward and occupied a position off Ochre Point, at anchor, some 800 yards from the shore. The exact range of the batteries was obtained from the bearings at anchor, and the guns were fired over the cliffs at the elevation required for the range. To get the direction, observers were sent aloft to locate the forts and indicate their bearing, as for instance over a certain gable roof, or over a certain chimney. The effect of the fire could not be observed, but the range and

direction were known absolutely and it was reasonable to suppose that the shots would fall with fair accuracy. The cliffs and houses did not interfere, as the trajectories, with full charges, passed three or four times higher than any intervening objects. No return was made to this fire, as the guns of the forts did not train in the direction of the ships, and there were no range stations for the mortars. Some had been planned, but they were not connected. This part of the bombardment was no doubt the decisive feature. Even should it be granted that the damage to the batteries was inconsiderable, owing to the impossibility of observing the effect of the fire, one of the reasons for the existence of the forts was the defense of Newport, and Newport was at the mercy of the ships.

The night attack was spectacular rather than useful. It would have been next to impossible in time of war. It could not have been attempted had the channel been thoroughly mined and defended by controlled and automobile torpedoes and torpedo-boats. Under the existing conditions of din, smoke and searchlight glare it was a very pretty and creditable bit of navigation, and was carried through without mishap of any sort. The ships went through in column at distance at a speed of 9 knots, steamed around Gould Island, and went out in the same order. This maneuver would have required some skill and care even in the day time.

A few of the conclusions that have been arrived at, or confirmed, as a result of the maneuvers may now be mentioned. In the first place, the conditions were artificial, and were devised with a special end in view, as has been stated. It would be impossible to suppose that in actual war the army would not have the co-operation of a floating defense. It might be said that the maneuvers tested the *shore* defenses. The *coast* defenses, in the full sense, did not enter at all. The outer line of coast defense is the fleet. Were it powerful enough, no shore defenses would be required. So, were all the shores fortified to the point of impregnability, a navy, considered in relation to defense alone, would not be necessary. Neither of these procedures is possible, or desirable. But a compact, mobile fleet will keep an enemy at a distance from our shores, or at least prove a predominating menace in case he slips through. In such a contingency, the second line of floating defense, and the

shore defenses, find the reason for their existence. They are to hold the enemy until the battle fleet can dispose of him. No success in war comes from merely resisting attacks. There must be the power to strike. Forts might resist an enemy forever and never defeat him. But at the proper moment the fleet may exterminate him.

So the inner line of floating defense, and the fixed defenses work together. A mine field not patrolled may be swept, dragged and countermined in a fog. The heavy guns of the forts are the main reliance; but there should be light draft harbor defense vessels to lie on the shoals and harass the enemy; torpedo boats to deter him by night, and submarine boats by day; searchlights to illuminate him; and position-finders to locate him and give his range to the gunners; submarine mine fields and batteries of automobile and controlled torpedoes to prevent his entrance; rapid-fire guns to cover the mine fields; and light vessels to patrol them: all these features in co-ordination constitute the perfect defense.

In our peaceful maneuvers an attempt was made to find the enemy by the use of searchlights. In most cases such use is apt to prove a positive disadvantage to the defense and a positive advantage to the enemy. Many nights' experience behind and in front of a searchlight have convinced the writer that under ordinary circumstances the mere flashing of the beams before the eyes of the observers gradually contracts their pupils until they cannot see as far, even on a bright moonlight night, as they can on an ordinary dark night without such questionable aids.

But if the lights are harmful in this way to the defense, in like degree they are an aid to the attack. They are a perfect lighthouse for purposes of navigation. Moreover they reveal the condition of mind of the defense. If the lights are sweeping slowly and regularly, it indicates a feeling of security. But let any suspicious objects appear; instantly the lights are dancing in every direction. They then settle down for a period of investigation. If the result is satisfactory, they resume the slow sweeping. So, when you are picked up; they pass over you fitfully once or twice, then they settle on you for an instant, and perhaps pass on satisfied. Then you hurry on to the best of your ability; but when they have got you finally, there is no mis-

taking it. If they had not used the lights they might have had you some time before, and you would never have known their intentions until a sheet of flame told you the game had begun. So in a concerted attack, the admiral makes a feint preparatory to the real attack. If he finds everything is going well in the direction of the feint, he may follow with the main attack in the same line. Or he may decide that a favorable diversion has been created and then push home his attack in another direction. None of this would be indicated were the searchlights not used.

There is one exception to this reasoning. In case the enemy must cross certain fixed zones or sectors, and these zones or sectors may be covered by fixed beams of light originating from points quite remote from the observers, then the logical use of the lights is apparent. So used, they are a great help to the defense, and the attack has nothing to do but make the best of the circumstance.

The method of getting touch of an enemy who has eluded the outer line of defense will most certainly be by means of the scouts of the inner line. These small vessels will no doubt be equipped with some practicable system of wireless telegraphy, synchronized if possible and made proof against interference. After the receipt of whatever information may come from such a source, there will be nothing to do except keep a number of sharp-eyed observers, equipped with good night glasses, busily engaged scanning all the approaches, and the prospect of discovering the enemy's intentions will be as good as can be hoped for.

Searchlights is then a misnomer, as they should never be used in searching; but they are needed for illuminating the target in the interest of the gunners and range observers. Lights used for this purpose should be quite removed from the gunners and observers who depend on them. There are two reasons for this; first, the glare of the beams does not affect vision to such an extent; second, the reflected light seems better when it comes back at an angle with the original beam instead of in the same line, perhaps only through contrast. Some very comprehensive experiments made in Italy a dozen or more years ago determined that the maximum visual effect was obtained when the angle between the illuminating beam and the line of vision was 60° (from memory). This pri [illegible]

use of in locating the illuminating lights. It is superfluous to add that all such lights should be effectually hooded on all sides except in the direction of the beam. The effect should be that of a bull's-eye dark lantern.

The term blinding lights has sometimes been used. The consensus of opinion afloat was that the blinding effect was of no consequence at the ranges that would be used in a bombardment. It is possible that in a torpedo-boat attack on ships the boats might be blinded at very close ranges, but at that point their work should be finished. The lights are used properly in this work only after the boats are discovered. The ships are best in darkness, leaving to the destroyers and vedettes the task of making known the approach of attacking boats. Some reports stated that the range observers ashore were occasionally blinded by the ships' lights, and recommended that the lights be directed on the range towers. This is probably desirable; at least, there is no doubt of it while the towers are under fire. Perhaps later the lights are best used on the batteries, or whatever may be the target for the moment.

To the observer afloat the various adjuncts at most of the forts come into a very marked prominence. Searchlight stands and vertical base-position towers seemed to be the worst offenders. There were also buildings and barracks that showed plainly, and while they had no offensive value, a well informed enemy would use them as marks by which to sight his guns at emplacements otherwise concealed. The modern idea in fortification is concealment and dispersion as opposed to the old protection and concentration. It would seem that the sky line of our forts should be a perfectly unbroken line with nothing to claim the eye of the opposing marksman. In the neighborhood of foreign works, peaceful objects of prominence are often razed with no other motive in view. Such a policy would eliminate vertical bases except on sites sufficiently elevated not to require an additional tower.

Some discussion has taken place in the fleet as to the advisability of steering sinuous courses in a mere run-past. Of course in a bombardment it is well to keep moving. But in a run-past, the main point is to save time. If a sinuous course is steered, it is evident that the changes must occur at least as frequently as the predictions of the range observers, otherwise

the prediction holds for the new course. Now, assuming a certain speed of predictions, and the ship maintaining a general advance, how much can she change her position from that predicted in one interval of predictions by any possible change of helm or speed? If the change is less than the error of the prediction, or of the marksmanship at the given range, the attempt is entirely useless. It prolongs the time under fire and serves no useful purpose. The rest is a simple geometrical calculation, the data being given. With such data as the writer has been able to obtain, changes of course have nothing to recommend them.

During the period of the maneuvers the weather was persistently clear. In the absence of a floating defense, running the Race in a fog should be a perfectly practicable maneuver. It would most certainly have been attempted had the occasion arisen. The clear weather was of course to the advantage of the defense throughout, and the attack had nothing to do except make the most of it. The ships would have been much less conspicuous at all times had they been painted war color, and this should be done in future maneuvers. In fact, in the opinion of the writer, it would be much better to keep them war color all the time. They are more impressive, look more like business, create a better moral effect, are ready to take part in any exercises or maneuvers or search problems, permit experiments as to the best color of paint, and last and more important than all, are ready for work at any moment their services may be needed.

These joint maneuvers may well be continued. The gain to the coast artillery is probably greater than it is to the navy. It gives them their only possible opportunity of service under something like war conditions, whereas the navy is mobilized and at work at something most of the time. It brings about an understanding, too, between the services. The interchange of observers ashore and afloat, as provided under the rules, cannot but bring about a mutual feeling of good will and respect. The writer saw a good deal of the army during and before the maneuvers, and realized, as we all should, that in any future difficulties, we have got to stand shoulder to shoulder, and the better we know each other the better we can do it.

GREBLE
WETHERILL
ADAI

NORTH ATLANTIC STATION.

U. S. FLAGSHIP KEARSARGE (*1st rate*),

Off Block Island, Rhode Island, September 6, 1902.

BULLETIN:

The Army and Navy maneuvers having been completed the following is printed for the information of the Fleet:

The Fleet composed of:

Kearsarge,	Montgomery,
Brooklyn,	Mayflower,
Alabama,	Gloucester,
Massachusetts,	Scorpion,
Indiana,	Supply,
Puritan,	Aileen,
Olympia,	Nina,
Panther,	Leyden,

Peoria,

having rendezvoused Menemsha Bight by sundown Sunday, the 31st ultimo, they were assigned as follows:

First Squadron:

1. Kearsarge,
2. Massachusetts,
3. Alabama,
4. Indiana.

Second Squadron:

1. Brooklyn,
2. Olympia,
3. Montgomery,
4. Mayflower.

First Reserve Squadron:

1. Panther,
2. Supply,
3. Nina.
4. Leyden.

Second Reserve Squadron:

1. Puritan,
2. Aileen,
3. Peoria.

Scouts:

Gloucester. Scorpion.

The Nina and Leyden to act as tenders and not a part of the force designated for the maneuvers.

After dark on the 31st of August the Supply, Gloucester, and Lebanon (collier) were despatched to Block Island to anchor off the entrance to Great Salt Pond and to await the arrival of the Fleet. At 10.40 p. m., the same night, the Fleet got underway and headed to the westward. The Olympia was detached shortly after getting underway. The Olympia landed one company of Naval Reserves, in charge of Lieutenant Goodrich, M. V. M., at Gay Head, and occupied the signal station there; finding the station established by the Army a couple of days previously abandoned; then proceeded to Woods Hole and cut all the cables connecting Martha's Vineyard with the mainland; sending telegrams to General MacArthur that this had been done. The cables were actually grappled, hauled up on the bows of a launch and all tools at hand to cut cables, all this to the satisfaction of the Umpire.

The Fleet arrived off west side of Block Island at early daylight on the morning of September 1st. The Brooklyn, Massachusetts, Indiana, and Puritan shelled Beacon Hill with secondary batteries. The Alabama landed two companies of bluejackets who advanced on Beacon Hill by two routes and captured it. There were a sergeant and four men in charge of the station, with no supports. The Army Observer on board the Alabama acceded to the capture with no protest. The marines from the Kearsarge, Alabama, Massachusetts, Brooklyn, and Olympia were landed and established a camp under command of Captain Magill, Fleet Marine Officer. The Fleet anchored and preparations were made for further operations; the small vessels and collier inside Great Salt Pond.

The Scorpion was despatched at 10 a. m. September 2d to reconnoiter the channel around south end of Gardiners Island. The Scorpion returned before dark, reporting that she had run on an obstruction and was placed out of action for repairs by the ruling of the Umpire. The obstruction was a barge 200 feet long, 10 feet deep, loaded with stone.

After dark on September 1st a Scouting Squadron, under the command of Commander Wilson, of the Panther, with the Supply, Montgomery and Mayflower, got underway and scouted the enemy's ccast from Price's Neck, Newport, to Fisher's Island. This squadron located the search-lights along this part of the coast and drew the fire of the forts at Newport while off Brenton Reef Lightship. They returned and anchored at Block Island about daylight.

The Brooklyn and Massachusetts left the Base about 10 p. m. September 1st to run through the Race, Gull Island passage, and take Fort Terry, on Plum Island, in reverse. The battleships Kearsarge, Alabama, Indiana, and monitor Puritan got underway at 1.40 a. m. September 2d and advanced to attack Fort Gardiner and Fort Terry from the south. Both fleets were in position by daylight, the fort on Gardiner's Island was put out of action by points, and a cross fire established on Plum Island. It is claimed from this action that Plum Island was captured and the fort on Great Gull Island by position, the Fleet being in its rear where none of its guns would bear.

A force, composed of the Brooklyn, Olympia, Puritan, Montgomery, Mayflower, Peoria, Aileen, and Gloucester, under the command of Rear-Admiral Coghlan, was despatched the 2d instant, for an attack upon Fort Rodman, New Bedford. This attack was carried out the following day, the vessels returning to the Base that night, except the Brooklyn and Peoria. The Olympia had picked up the company of Massachusetts Naval Militia before this attack. The Brooklyn, in withdrawing from the action, struck an uncharted obstruction which dented her bottom slightly and delayed her return until the following day looking for the obstruction. The damage was not serious and she continued with the Fleet until the close of the maneuvers.

The morning of the 2nd the Leyden surveyed a channel with 18 feet of water around the obstruction in the channel to the southward of Gardiner's Island, and joined the Fleet off Cerberus Shoal.

At daylight on the morning of the 3rd the Kearsarge, Alabama, Massachusetts and Indiana bombarded Fort Wright for about two hours, then

withdrew and anchored at the Base. The ships steamed close along the south face of the fort, then doubled around Race Point taking the batteries in reverse; returning by the same course.

On the morning of the 4th, about 4 o'clock, the Kearsarge, Alabama and Massachusetts got underway and stood for the Race, intending to run through as the weather was thick, but it cleared and they stood off to the northward and eastward toward Newport, then back to the Base where the Indiana joined them and they kept underway the rest of the day, the Indiana anchoring before dark. After dark the Brooklyn and Olympia leading, with the three battleships, Kearsarge, Alabama and Massachusetts, about a mile behind, ran by the forts at the Race. The Brooklyn and Olympia directed their fire to put out the search-lights; also, to draw the beams of the search-lights to them and allow the battleships to get as close as possible before being discovered. The night was very clear and not the one that would be selected for such an undertaking, but the ruse was fairly successful and the battleships got within close range before they were discovered. The ships anchored about half-past one on the morning of the 5th off Horton's Point, Long Island, and got underway at five o'clock, proceeding to a place off Newport, outside of the range of the guns.

The afternoon of the 4th, an expedition, under the command of Commander Wilson, of the Panther, with the Supply and Scorpion, proceeded to Fort Pond Bay, Long Island, cleared the beach by shelling, landed the battalions, captured a force of 130 and some signal stations and held the place until ordered to withdraw the afternoon of the 5th. The Scorpion rejoined the Fleet.

The forenoon of the 5th the vessels rendezvoused off Newport for a bombardment. The plan of the attack was to anchor the Massachusetts, Indiana and Puritan off Ochre Point and shell Forts Adams and Wetherell over the land, enfilading Wetherell and taking Fort Adams in reverse. The Montgomery, Mayflower and Scorpion attacked a signal and observation station at Price's Neck. The Umpire allowed that this was put out of action, but the boats' crews sent ashore to capture the place were ruled out as captured or killed. The Brooklyn and Olympia attacked the station near Narragansett Pier, which the Umpire allowed was out of action after twenty minutes' shelling with the secondary batteries. The Kearsarge and Alabama bombarded Forts Adams and Wetherell by zigzagging in the dead angle, of direct gun-fire, of Adams, Wetherell and Greble; the intention being to pass inside and to the eastward of Brenton Reef Lightship before turning out. It was not considered advisable to risk the ships for the purpose of maneuvers, inside the lightship, where uncharted rocks might be run upon.

The night of the 4th, Lieutenant S. S. Robinson and Lieutenant C. F. Hughes, with the Peoria and a sailing launch cleared the channels at Newport by dragging and countermining. With the Peoria they dragged half-way across the western channel before being discovered and fired upon and they continued to drag completely across under the fire. They then planted countermines with buoys to mark the line of the mines in the eastern channel and exploded them, then anchored inside until the next

morning. They were under the beams of the search-lights while countermining but were not fired upon. The next morning, under a flag of truce, they removed the mines and buoys, being dangerous to navigation, and found that all the fuses of the mines had operated.

The night of the 5th instant the Brooklyn, Olympia, Kearsarge, Alabama, Massachusetts, in this order, formed to run the batteries at Newport through the eastern channel. (The Montgomery sailed to New York, the other ships proceeded to the Base.) The ships started ahead about 9 o'clock in the evening and ran by the batteries, finding no difficulty in navigating in spite of the glare of seven or eight search-lights directed upon them at once. (The guns were not fired, except by the rear vessels, as the smoke might have caused a serious accident.) The vessels turned around Gould Island and went to sea, returning to the Base and anchored.

The morning of the 6th the whole Fleet, with the exception of the Montgomery, was at anchor at the Base, Block Island, R. I. The Kearsarge, Alabama and Massachusetts passed in review before the forts at the eastern end of Long Island Sound, returning to Block Island and the maneuvers were completed.

FRANCIS J. HIGGINSON, *Rear-Admiral,*
Commander-in-Chief, U. S. Naval Force, North Atlantic Station.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NAVAL ADMINISTRATION, II.*

By Rear Admiral S. B. Luce, U. S. Navy.

"Had it not been for you English, I should have been Emperor of the East," said Napoleon to Captain Maitland, on board the Bellerophon in 1815, "but wherever there is water to float a ship we are sure to find you in our way!"

Such was the splendid tribute paid to the efficiency of the Naval Administration of England by the first Captain of the age.

In the great game of war he had been pitted against the Board of Admiralty. The stake was nothing less than an empire—England and her vast colonial possessions. The theatre of war embraced, practically, the four quarters of the globe. He had played the game to a finish, and had lost; and, while a captive on board an English man-of-war, cruel fate wrung from him that well-deserved tribute to the ability with which the naval operations of England had been directed during the greatest war of modern times.

The Trafalgar Campaign furnishes an apt illustration of a fundamental truth, as laid down by an eminent authority, that the effectiveness of a military instrument—such as a navy—consists more in the method of its use, and in the practical skill of the human element that wields it, than in the material perfection of the weapon itself.

Powerful ships and a well-trained personnel would be of compartively little use in war, were the skill wanting to use them effectively in their aggregated form.

From this obvious truth it will be seen that naval adminis-

* For Naval Administration, I, see Proceedings of U. S. Naval Institute, vol. XIV, No. 3, June 6, 1888.

tration includes several separate and distinct branches; such as the building and equipping of ships and the installation of their batteries, etc., which comes under the general head of *Matériel;* the manning of ships, which comes under the head of *Personnel;* and their maintenance, which belongs to *Finance*. These three divisions belong to the Civil Branch of Naval Administration. The fourth division includes the management of the aggregation of ships; in other words, the wielding of a navy as a weapon. This is the *Military* branch. To fulfil the duties of this office requires a knowledge of the art of war in its most comprehensive sense, and a familiarity with the Laws of War, as laid down by the best authorities on Marine International Law. The office, moreover, should be wholly unencumbered with the administrative and executive duties of a Bureau. It is in this latter branch that the Naval Administration of the United States is deficient. It recognizes no such office. This is a fatal defect in our system.

We have had for our study during the past century the Napoleonic wars, and the naval operations they gave rise to. We realize the fact that wars on earth have not ceased. We know that two generations are scarcely ever permitted to pass without a war. We fully understand that when war does come the surest means of defense is to assume the offensive. And we know from the teachings of all history, and from the admonitions of our best and wisest statesmen and warriors, that to ensure the blessings of peace a nation must be prepared for war.

Knowing all this as we do, it is certainly extraordinary that "practical Americans," as we are fond of calling ourselves, should complacently submit to see our Navy Department, organized for a state of perpetual peace: to rest content to see excluded from its make-up the military element that should wield the navy as a weapon of war.

It is our purpose to show that the military branch should receive immediate recognition and be admitted into our scheme of Naval Administration without further loss of time.

It matters little whether the office we have indicated be called a Board of Navy Commissioners, a Board of Admiralty, a Strategy Board, a War Board, a General Board, or a General Staff. The essential point is to have attached to, and made part of, the Secretariate—the office of the Secretary of the Navy—offi-

cers charged with the duty of preparing plans for naval campaigns, and of directing, under the Secretary of the Navy, the military operations of our several fleets and squadrons. Such a Board, by what name soever it may be known, would represent the Military Branch of the Navy Department, now lacking, as distinct from the Civil, as already explained. It would constitute the brain of naval operations.

It was through the want of the Military Branch that the Navy Department has, on several notable occasions, in the not very remote past, been thrown into such states of panic as to fully demonstrate its incapacity to perform the very duties for which it was created.

On the imminence of hostilities, and under dire necessity, such a board has had to be hastily brought into existence, only to be improvidently dissolved when the crisis had passed.

Since 1812, when Captains Stewart and Bainbridge successfully protested against the administration's policy of laying up the entire navy, lest it should be swept out of existence by English cruisers, up to the present year of grace, 1902, the military functions, which should have been performed by the Navy Department, have been performed, for the most part, by officers outside of the Navy Department and in no way connected with its organization. During all these years the Navy Department has, with a single exception, shown itself impotent to perform its military functions. The exception is furnished by the period included between the year 1815, when a Board of Navy Commissioners was, by law, attached to the office of Secretary of the Navy, and the year 1842, when that board was abolished, and the Secretary left the sole occupant of his responsible office.

It was the board authorized by the Act of 1815 that "wielded the Navy as a weapon," and it is conceded, on all sides, that during the period named, the navy reached its highest point of efficiency and discipline, and it was a strange oversight, indeed, that in the reorganization of the Department in 1842, the head thereof should have been left in the utterly false position of a civilian called upon to administer the affairs of the great executive department of the government having to do with naval and military matters, without a professional assistant.

The Act of 1842, instead of retaining the commissioners then attached to the Secretary's office, or retaining at least one of

them, as suggested at the time, and adding the Bureaus, unwisely abolished the Board outright, leaving to the Secretary a civilian chief clerk only.

It was assumed that the Secretary would have all the advantages of a staff in the Chiefs of the Bureaus. The officers of large experience were still there, only, instead of calling them commissioners, they were thenceforth to be known as chiefs of bureaus, and although no longer in the Secretary's office, as part of the Secretariate, they were still in the Department and could be called in consultation at the pleasure of the Secretary. This was, theoretically, quite true, and answered very well for a time of peace and when people generally scouted at the idea of that peace ever being disturbed. The Civil War rudely dispelled this idle dream, and proved the falsity of the theory on which the organization of the Department was based.

On the opening of hostilities the Secretary soon found that the Chiefs of the several Bureaus were so engrossed by the sudden and great demands made upon their resources as to leave them no time for counsel. However great the crisis, and it was very great, however pressing the necessity, the Bureau Chiefs found themselves too much absorbed by their own duties to spare the time, and give the necessary thought to other duties. Moreover, their work was with matériel and was civil in its character, while the questions with which the Secretary had to deal had to do with the personnel, and was of a strictly military character; for it must be remembered that at this time there was no Office of Detail. That duty was discharged by the Secretary himself and his chief clerk. Thus at the outbreak of the Civil War the Secretary of the Navy found himself in a complete state of isolation.

The services of the old Board of Navy Commissioners were now sorely needed.

The position was an awkward one, not to say extremely embarrassing. Finding itself confronted with the actualities of war, while sensible of its incapacity to deal with its responsibilities, the Department was forced to adopt various make-shifts to meet the sudden and pressing demands upon it.

To attend to the duties of the Office of Detail, which the Secretary found no longer possible, himself, to discharge, he lost no time in calling to his aid Captain Silas H. Stringham, a

fine representative of the old school of naval officers. In Captain Stringham's intimate knowledge of the service, and sound judgment, the Secretary placed implicit confidence. Their relations were of a personal and confidential character, such as should subsist between the head of the Department and his chief of staff.

This was the first step towards the establishment of the Office of Detail as it exists to-day.

The second step was somewhat out of the ordinary course. Under date of April 1, 1861, an order, signed by President Lincoln, directed Captain Samuel Barron, U. S. N., to relieve Captain Stringham. By the terms of the order the Secretary was to instruct Captain Barron "to proceed and organize the Bureau of Detail in the manner best adapted to meet the wants of the service." Captain Barron at that time held an appointment as a captain in the Confederate Navy, and by a curious turn of the wheel of fortune surrendered to Commodore Stringham, five months later, as prisoner of war on the reduction of the forts at Hatteras Inlet.

The order of President Lincoln was not carried into effect, it is true. On the nature of the order being explained to the President he promptly rescinded it. The incident is referred to simply to show the chaotic state of affairs which prevailed at that time in Washington, in general, and in the Navy Department in particular. Captain Paulding succeeded to the head of the Office of Detail.

The embarrassment of the Department increased with the increasing gravity of the situation. It found itself with a war on its hands, and no one to direct the operations of war. Spasmodic efforts were made to call into existence a board of officers that would take the very responsible duty in hand. An effort was made to unite the bureau chiefs into a sort of Board of Admiralty, but this proved a signal failure for the reasons already given. Each chief had just as much as he could possibly attend to in the business of his own Bureau.

The only board produced by these panicky times equal to the occasion, and the one which approached in certain respects to the character of a general staff, was that known as the Committee of Conference. Singular to say, that committee owed its existence to a civilian, Professor A. D. Bache, the very learned super-

intendent of the Coast Survey. Captain S. F. Dupont was the chairman, with Commander Charles Henry Davis as secretary. Major Barnard represented the Army. From the character of the officers composing this committee it will be readily understood that a very comprehensive view was taken of the entire field to be covered by the Navy. The plan of campaign included the blockade of the southern ports of the Atlantic and Gulf coasts and the Mississippi river. The reduction of the forts at Hatteras Inlet was the first fruit of its labors.

The capture of Port Royal, S. C., followed. The wedging in of a strong naval force between Charleston and Savannah, to be a continual menace to each, and the establishing of a permanent military and naval base at such an important strategic point in the Confederacy, was, from a military point of view, one of the most important naval operations of the war, and yet the Navy Department is not entitled to a particle of credit for it, beyond the generous supplies of personnel and matériel which made the movement a success. The movement itself had its genesis in the Committee of Conference; and its fruition in the ability of Flag Officer Dupont and the members of his very able staff.

The Navy Department furnished the means, indeed, but the brains came from without.

When Captain Fox came into office as Assistant Secretary of the Navy, he was already familiar with the plan of campaign drawn up by the Committee of Conference. The wheels having been set in motion by outside parties, he had comparatively little difficulty, with his thorough knowledge of naval affairs and great business capacity, in keeping them going.*

Captain Fox supplied the place of the "one navy commissioner," which had been urgently recommended when the Department was re-organized in 1842.

When, after the Civil War, Captain Fox's term of office expired, he was succeeded by a civilian; and, later on, the law authorizing an Assistant Secretary of the Navy was repealed. The lesson of the Civil War was thrown away upon us, and the Department relapsed into a state looking to the early advent of the millennium, when wars on earth shall cease.

* See Life of Charles Henry Davis, Rear-Admiral, by his son, Captain Charles H. Davis, U. S. N., Chap. VII, "The Navy Department in 1861," for much valuable and interesitng information on this subject.

From this dream of eternal peace the country was again awakened. It was in 1873 when the imminence of war with Spain, incident upon the seizure of the Virginius, on the high seas, and the execution of a number of her crew after the mockery of a court martial, spurred us to unwonted activity.

The impotence of the Navy Department to deal with questions relating to war was, once more, made painfully manifest. There was no Bureau, no office, in the Department where the consideration of military questions was made part of its business. That part of the "business" of the Department had not been provided for.

The gravity of the situation admitted of no delay, however. Notwithstanding the fact that the administration had practically ignored Admiral Porter, the Secretary of the Navy and two of the chiefs of Bureau repaired to the residence of that distinguished officer for the counsel the Department should have found within itself. The panic over, the department suffered another relapse, and another lesson was lost upon us.

The assault upon the seamen of the Baltimore, in Valparaiso in 1892, strained the relations between Chili and the United States to the very verge of rupture, and once more brought out in a strong light the incapacity of the Navy Department to deal with the problems of war. Fortunately, the Secretary of the Navy, at this critical period, was a military man. General Tracy enjoyed an enviable war record. But even under such favorable circumstances, aid from without was summoned. It was still more fortunate that the trouble soon blew over.

And yet with all this experience—the Civil War, the Virginius panic and the Chilian imbroglio—each case showing conclusively the inability of the Department, of itself, to deal with questions of war, the breaking out of hostilities with Spain in 1898 brought out the same inefficiency of the government to promptly utilize the floating force at its command. The Department for the fourth time had to go outside and call to its aid the old Board of Navy Commissioners under another name.

The Naval War Board (or Strategy Board as it came to be known), which throughout the war acted as an Advisory Board to the Secretary, was the outgrowth of an informal Advisory Board, which had existed from the time when war was first seen to be inevitable.

It was the duty of the Board to advise the Secretary in regard to the Department's strategic policy. To this end, it prepared for his consideration, and signature, orders affecting this policy. Throughout the period of hostilities the Board was in session daily.

Now it may be observed in regard to these various war boards, under what name soever they may be known, that they are illegal.

Congress has declared that "*the business of the Department shall be distributed in such manner as the Secretary of the Navy shall judge to be expedient, among the eight Bureaus.*"

Hence, to go outside of the Bureaus and entrust some of its most important "business," such as the direction of naval operations, to a Strategic Board, the Department is clearly going outside the law. Not that it makes a particle of difference, in such cases, whether the law is transgressed or not. Necessity overrides the law. The question for the "practical American" is: Whether we shall continue to turn a deaf ear to the lessons of history, and calmly await the next crisis in international affairs to throw us into another panic, and convene another board for the occasion, or whether we shall profit by the admonitions of the past, and have such a board made a permanent part of our naval establishment by legal enactment?

There is a serious objection to "scratch boards," to use a colloquialism. Their plans of naval campaigns lack the very essential element of maturity. It is an accepted axiom that a mistake in strategy is much more far-reaching than a mistake in tactics. In time of war it is not enough for the government to tell an admiral commanding a fleet to "go out and do something." The Italian ministry tried that, to their sorrow, in 1866. "The Austrian flag must disappear from the Adriatic. Do as you think best," wrote the Minister of the Italian Marine to Admiral Persano. And again he wrote: "Lissa, by its central position, would ensure us the sovereignty of the Adriatic; let us take Lissa." This was not the language of a strategist, and Persano, who should have known better, wasted ammunition, coal, ships, and morale in bombarding the forts on the Island of Lissa. In this state of "considerable embarrassment," to use his own language, he was surprised and defeated by the Austrian Squadron under Tegetthoff.

Persano was tried by court martial and dismissed from the service. But surely the Minister of Marine was not blameless. He should have instructed the admiral that the Austrian Squadron was his objective, and that nothing must divert him from that end.

It is very clear that neither the Minister of Marine nor the admiral commanding the fleet knew his business.

Or let us take the more recent case of the Spanish Admiral, Cervera. There is something pathetic in his vain appeals to his government for a plan of campaign. "If we are caught without a war plan," he wrote, "there will be vacillations and doubts; and after defeat there may come humiliation and shame."

Again, on the eve of war: "I regret very much to have to sail without having agreed upon some plan, even on general lines, for which purpose I repeatedly requested permission to go to Madrid." And, finally, April 22, "you talk about plans, and in spite of all my efforts to have some laid down, as it was wise and prudent, my desires have been disappointed. . . . There is no plan or concert which I so much desired and called for so often."

Admiral Cervera, we rather opine, asked for what did not exist. It is more than doubtful if the Minister of the Spanish Marine had any plan of naval campaign to give.

If it be urged in behalf of the Department that custom has invested the Chief of the Bureau of Navigation with the attributes of an Adjutant-General, and that as Officer of Detail he is virtually the chief-of-staff to the Secretary of the Navy, the answer is plain: He cannot serve two masters. In addition to the large and varied duties of his own office, he is responsible for the disbursing, annually, of about one million dollars of public funds. Whatever may be his abilities and inclinations, he has not the time for the consideration of the larger questions affecting our international relations and the naval strategy which belongs to a period of peace. The utmost that can be expected of him is that he shall act as a connecting link between the Department of which he forms a part and the outside Advisory Board of Strategy. And this brings us back to the question: Why not have this Strategy Board or General Board, since it is seen to be indispensable, made a part of the regular machinery of Department?

Under the present crude system some of our methods are peculiar, to say the least.

When despatches from Nelson reached London in 1805, announcing the sailing of the French fleet from the West Indies, none knew whither, the First Lord of the Admiralty, Admiral Lord Barham, we are told, was furious because they had not been given him the moment of their arrival, although it was midnight. Precious hours had been lost, but by 9 a. m. messengers were hurrying to Portsmouth and Plymouth with orders to the various commands.*

As a result of these orders Admiral Calder, with the fleet under his command, took his station one hundred miles west of Cape Finisterre. On the 22d of July, thirteen days after the receipt of the despatches, the lifting of a heavy fog disclosed to Calder the presence of the French fleet. The battle which ensued was indecisive, it is true, but history furnishes few examples of such exact knowledge of strategy coupled with such rapidity of action. Napoleon was right. The English Admiralty knew its business.

On the breaking out of the war with Spain three whole days passed without sending instructions to Admiral Dewey, when our hand was forced by a British official.

A state of war existed from April 21, 1898. On Sunday, the 24th, a despatch was received from Admiral Dewey stating that the governor of Hong Kong had notified him that he must leave port, with the force under his command, within forty-eight hours. Appreciating the importance of the despatch, the Chief of the Bureau of Navigation took it at once to the President, the Navy Department being practically closed. With the President were the Secretary of State, the Attorney-General and one or two others. The account goes on to say: The despatch from Admiral Dewey and the reply to be sent were discussed by those present. The President then indicated the despatch to Dewey to proceed to Manila and attack the Spanish naval force assembled there. The despatch was written by the Chief of Bureau of Navigation and handed to the President, who read it aloud. It was approved with the adding of the word "destroy," so as to read: "Capture or destroy." The despatch was then

* See the admirable account of the Trafalgar Campaign in "Influence of Sea Power" by Captain A. I. Mahan, U. S. N.

taken to the Navy Department, where it was rendered into cipher.

The Secretary of the Navy was not with the President when the latter dictated the message, but later in the day he saw the despatch in the Department, signed it and it was sent.

War had been "in the air," so to speak, for six months. The order to blockade the Cuban ports was dated April 21. Yet it was left for the Governor of Hong Kong three days later to order an American Squadron to sea, with a home-port 6,000 miles away!

It is far from our purpose to criticise the war policy of the late administration. No doubt the President acted with his accustomed wisdom. But of this we may feel reasonably sure: Had the Board of Navy Commissioners come down to us in an unbroken line, Admiral Dewey would not have been left so long in the isolated and trying position in which he found himself after the victory of May 1.

War existed from April 21. The Navy Commissioners would have started re-enforcements from San Francisco *in advance of that time,* knowing war was inevitable, and that, in any event, Dewey would need them. By the timely arrival of re-enforcements the Philippine insurrection would have been averted, without doubt, and much blood and treasure saved.

It has been well and truly said that "languid war is not to save blood and money, but to squander them."

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

HOW BEST TO MEET "THE NAVY'S GREATEST NEED."

By Lieutenant J. S. McKean, U. S. N.

It seems to be agreed that the question of ships is well on the way to solution. This leaves "The Navy's Greatest Need"—the proper supply and training of officers and men! We now have three methods of securing and training the men: 1st, "The Apprentice System"; 2nd, "The Landsmen Training System," and 3rd, but not least, the "Regular Service System." Each system has its good points, each has its partisans, and it is safe to say that if Congress gives us a sufficient increase in the number of men and boys allowed in the service, and the ships on board which to train them, that that part of the problem will be more or less satisfactorily solved—if we are at the same time given the third and equally important element of a fighting sea-force—officers!

It will certainly be admitted by anyone familiar with navy conditions that we need a great increase in the number of officers; that the present or prospective output of the Academy hardly supplies the waste, much less providing for the necessary increase. This in spite of the fact that the number of appointments has, in the past two years, been increased from 371 in six years to 495 in four years.

The object of this article is to give the writer's opinion of the best way to obtain the *number* and *kind* of officers required. He hopes by expressing himself fully and frankly to call out the opinions of others, each from his own point of view, and that thus, by the time the question of increase comes before Congress there will be a service opinion on the best way to secure this increase.

There are three methods of securing officers: (1) From civil life with the general education completed and the professional training to be acquired in service. (2) From the ranks. This is being done, but the amount of available material from this source is so small as to be insignificant. (3) From the Naval Academy. The writer thinks that there will be very few not of the opinion that we can get *better* officers in a *shorter time* via the Academy route than by any other. He also thinks that there will be very few, if any, who will not agree with him that midshipmen must be *educated* and *trained* by naval officers and that it cannot properly be done by civilians. The time element is the big question at the Academy, always has been and is even more pressing now, for whether we approve or not amalgamation "*Is the Law*," and has come to stay, and the midshipmen of to-day must be educated and trained for both deck and engine-room and it must and *can* be done in the four academic years. To do this the "education" and "training" must go on simultaneously, and that is only possible when both are in the same hands. The writer believes, from what his own experience has taught him and from the expressed opinions of a number of good observers who have had excellent opportunities to watch results at the Academy under different methods, that with naval officers for instructors the educational side of the course does *not* suffer and that the "training" in their hands is, as one would expect, so far superior to the lack of training by civilians that a comparison is impossible.

The practical limit of the number of midshipmen that can be trained at any one time is the capacity of the Academy as it will be in two years from now (by the time the changes suggested can first have their full effect). This limit will be about 1440.

Believing, as the writer does, in the absolute correctness of the argument by Lt.-Comdr. Roy C. Smith in his articles in the NAVAL INSTITUTE PROCEEDINGS for June, 1902, and the North American Review for September, 1902, he thinks that immediate increase of the quarters now building at the Academy should be appropriated for so that this number (1440) could be comfortably and healthily quartered in the new buildings, without the doubling up that would have to be done to get 1440 into a building designed to accommodate 720—the capacity of the

quarters now building. When the Academy has been expanded to accommodate 1440 permanently, there can, by doubling up, be put in the 2000 which will be required for a few years to make up for the neglect and short-sightedness of the past twenty years—since August 5, 1882.

The first step in securing a properly educated and trained officer is his selection for appointment to the Academy. Here is where the first change in the present law and methods should be made. The foundation of all the courses of the Academy must be the average capacity of the midshipmen appointed. The aim should be to have this as high as possible and as uniform as possible throughout a class. The writer's idea of how best to obtain this is to so change the law as to have the age limits 16 and 19, making the average age about 18. The present limits, 15 to 20, gives too wide a range; for, while a *very exceptional* boy under 16 may pass the entrance examination, any number below the average capacity may pass who have had four more years of schooling. By the change of the age limits we would get boys of nearly the same age, the same ability, and in every way a more uniform class than with the wider range now allowed. With no "small boys" and no "old men," I think studies, drills, discipline, etc., could be adjusted to give better general results with less nursing of the tailenders, and at the same time keeping the leaders at a good cruising speed. As in a squadron, the speed of the squadron is that of the slowest ship—so in a class of midshipmen (now that the service needs every one they can *drive* or *coax* up to the necessary 2.5) the real speed of the class is adjusted to suit the absolute *best* efforts of the *last* man the Academic Board thinks worthy of a diploma. Having secured an almost uniform age of 18, the entrance examination should be so adjusted that the best boys from good schools the country over should be just able to pass with the required 2.5. Some exceptional boys between 16 and 17 will pass and being exceptional boys should do well afterward (as the younger members of classes usually do) and some boys just under 19 will barely get 2.5, but they cannot be far below (in natural ability) the bright sixteen year old—not nearly so far as the young collegian of 20 is below the boy of 15 who now gets the same mark on the entrance examination.

Having determined the age and the lowest entrance limit,

the next question is—How to get the best material fulfilling these conditions? The entrance examinations are now held by the Civil Service Board of Examiners (the papers being prepared and marked at the Academy), at various points throughout the country, and this seems to work well. I believe that the system should be extended so that an examination should be held in at least every State in which there is a vacancy, and not only held by the Civil Service Board but Civil Service Rules should apply. The highest among the competitors should get the appointment—not one who can simply pass selected by the appointing officer for political, family or social reasons.

The 1440 appointments should be distributed as follows:

Representatives in Congress 1 every 2 years, making..	780
Senators 1 each year, making	360
The President 25 each year, making	100
At large, by competition, 50 each year, making........	200
	1440

By holding the examinations at numerous central points any boy could try for the appointment, and by giving sufficient publicity to the existence of vacancies of different kinds and from different districts the Congressman, Senator or President would have sufficient applications for permission to appear for the examination to enable each to select *at least* five (5) and not more than ten (10) competitors for each appointment. From this number the *examination* would select the one best fitted to fill the vacancy and he should get the appointment. All other applicants who passed successfully should be certified to the Secretary of the Navy by the Academic Board *in the order of merit*, and from this number, *in the order of merit*, should be selected a sufficient number to fill any vacancies due to all the candidates for any one appointment having failed to pass.

The 50 appointments each year "At Large" to be open to any and every boy of proper age and character. The examination for these should be the same and held at the same time and places as for other applicants and by proper publicity throughout the country there would be *at least* 500 candidates for these 50 appointments. The first 50, as determined by the examination, should be appointed and the others passing successfully should

be certified, in the order of merit, to the Secretary of the Navy from which to select individuals to fill remaining vacancies.

There will be objections to the above method, but if the appointing officer will remember that he can oblige at least ten of his friends, instead of but one, and give each of their sons just the opportunity to which his merits entitle him he will see that nothing would be taken from his patronage. If objectors, on other grounds, will study the relative proportions of graduates among competitive and non-competitive appointments, I think it will convince them that now when the navy needs every man who enters as a commissioned officer *as soon as it can get him, and of the very best material that can be found*, that these objectors, too, will agree to this method of selecting the appointees.

The necessary publicity to make the above examinations successful can be readily given by pamphlets sent to Senators, Congressmen, schools, colleges and all the newspapers of the districts in which vacancies are to occur.

Another and *most important* change as to admission would be to have but one examination each year, to take place not later than April 1. (The vacancies to be caused by the class graduating in June should be filled at this time so as to keep all places filled at all times.) The successful candidates to report for entrance by May 15.

The new fourth class or " Functions " secured as above should on entering be quartered on board sailing craft alongside the sea wall. The summer to be devoted to " setting-up " this raw material so that by October 1 they will be ready, in every respect, to take their places in the battalion and do it credit. In the four and one-half months that they will be on board, the ships to be in commission, with a *full* complement of officers (for ship duty and drills, afloat and ashore), and enough of a crew to keep the ship in the best of condition. During this four and one-half months, the first three and one-half to be alongside the dock with all the Academy plant available, these youngsters can be taught all the knotting, splicing, loosing, furling, reefing, log-line, lead-line, boxing compass, etc., that they need know; can learn the ship, the battery and its drill, and at the same time can be having daily drills in " setting-up," infantry, artillery, rowing, sailing, swimming, fencing, enough shop-work to learn

materials and the names and uses of hand tools; the firing, water-tending, oiling and engine tending of steam launches and the small gun-boats; signals, wig-wag, yard-arm and Ardois; and what seems to me, from my observation of the results with a part of this year's fourth class, of equal benefit, the thorough physical building up and "setting-up" of the above drills combined with the regular evening work in the gymnasium, made up of running, wand-drills, Indian-clubs, dumb-bells, punching-bag and boxing, ending with a plunge and rub down as the wind-up to a hard physical day's work which puts the most active and troublesome youngster in shape for a good night's sleep. He will get up the next morning, start the day with a run over the masthead and a plunge overboard, then a good hearty, healthy breakfast that will provide the necessary "blood, bone and beef" to replace what he has worked off and a little extra to go to increase of size and strength. I have seen the results of an approach to this regime and I think anyone who has observed the test will admit that the development produced is wonderful.

On September 1 enough sailor men from the other practice-ships should be put on board to make a small working crew, and the brigs should be sent for a month's cruise in Chesapeake Bay, each accompanied by a small gunboat or torpedo boat as tender and for steam drills. During this month the knowledge acquired at the dock could be fixed in the mind by practical use and extended by making these youngsters in turn fill all the positions and perform all the duties of seamen, petty, warrant and commissioned officers. They would learn steering, the handling of boats alongside, ground tackle, aids to navigation, the rules of the road and a preliminary idea of coast piloting. By taking duty on the tender, in groups, they would extend their knowledge of firing, water-tending, oiling, engine-tending and "steamanship" in general. As a result of this four and one-half months' work and *study* (while at the Academy one period each day devoted to study—mechanical drawing and French) there would be brought back to the Academy on October 1 a class of strong, healthy youngsters ready for their books and fitted to take their places in any and all drills, when the battalion drills as a whole, either afloat or ashore.

All of this work is done under the direct supervision of officers and the proficiency, conduct, etc., should be marked and

should count as a part of the academic course and in determining class standing.

The results will not consist wholly of improved physical condition and the knowledge acquired but will show in the first year's work and then fourth classmen will not have to learn to stand, walk, carry a rifle, salute, etc., at the same time they are studying general history, punctuation and algebra. They will have been fitted to their clothes and surroundings and are free to devote their whole mental energy to their books.

Under the conditions of entrance, with the age limits as given, and the *best* material selected by the competitive system outlined above, the writer believes that, by giving up two hours each day, for the three and one-half months that the ships lay alongside, to the study of mechanical drawing (a large time-absorber) and two hours each day of the cruise to the study of French or Spanish, it would be wise to announce at entrance that at the end of September there would be examinations held on all the subjects studied by the previous fourth class and equal to the semi-annual and annual examinations of the previous year, and that any midshipman passing these examinations would be at once advanced to the third class. With the summer training and summer study by the better fitted part of the class this should enable *at least* 10 per cent of every class, *selected as above*, to go at once into the third class and thus complete the course in three years. A three years' course which commences with the third class is simply admitting youngsters to where their previous education puts them and does not, as does a three years' course with the last year cut out, rob the midshipman of the purely professional part of his work, that part which is the real a, b, c of being an officer!

As to the course at the Academy there need be few additions to fit each midshipman to intelligently perform *any* and *all* the duties assigned a junior officer under the present law. The changes the writer would suggest are a reorganization and combination of departments and the *absolute transfer of all* PRACTICAL *instruction, in every subject, to the* PRACTICE CRUISES and DRILL PERIODS! This elimination of practical work from the study and recitation period would more than give room for any added theoretical instruction that may be necessary in mechanical, electrical, marine or ordnance engineering, and would add so

materially to the value of the cruises (and drills) that they can and should properly be made a part of the Academic Course and the marks on practical studies on the cruise, proficiency in the performance of duty, discipline aboard ship, etc., should count in a midshipman's standing, just as much as the theoretical study of the same or equally important subjects count at the Academy.

As will be seen under this plan, there will be four cruises (counting all of the first summer as a cruise), and each being a real part of the course, we have in effect extended the course from one of four years of eight months each, to one of four years of eleven months each. Of course this twelve months is not all gain, but in the added value of the cruises and drills (those devoted to "practical work"—laboratory, shop work or study in model rooms), I think we have gained the equivalent of at least one term at the Academy.

By a reorganization and combination of departments, it is believed that their number could be somewhat reduced without impairing efficiency. The writer's plan is as follows, viz.:

(1) *Organization and Discipline.*—This department to have charge under its head—the Commandant of Midshipmen, of the military organization, discipline, outfitting and maintenance of the midshipmen; of all distinctly military drills; under this department should come the present Department of Physiology and Hygiene whose scope should be extended to cover the direct and constant supervision of the food, clothing, quarters and daily physical training of every midshipman. It should direct the systematic development of each individual to his best physical form, fitting him for a long life of hard service, under trying conditions, such as every officer meets in service. (Here, though not immediately a part of the subject, the writer must register his protest against the waiving of physical defects at the entrance examinations. Such waiver is, at first, an injustice to another candidate; later is often an injury to the recipient of the favor, and still later is likely to be an injustice to the service and to an honorable retired list.)

As was said above, it is the individual best all around development that should keep the attention, not the training of athletes of a special kind or fitted for special games. All athletics should be under the direct supervision of this department.

While believing in the benefit of athletic contests, as an incentive to thorough physical training, and specifically in boating, foot-ball, fencing, rifle-teams and general field and track athletics, I do *not* believe that *any* form of athletics should be allowed to interfere with drills or studies—and that when the time necessary to make any sport successful at the Academy infringes to any appreciable extent on the time necessary for studies and drills (which become practical studies in this program), that it is time to leave that form of sport to schools with a less crowded curriculum. Further, the rule of some colleges should be adopted and enforced, that no midshipman who is unsatisfactory in any study should be allowed in training. This may seem to bar athletics, as popularly understood, but that is not the writer's meaning as will be seen when he says that the marks of the Department of Organization and Discipline should include: (1) efficiency; (2) general physical fitness as determined by the Medical Board each year; (3) fencing; (4) boxing; (5) shooting; (6) swimming; (7) general gymnastics. These marks to be combined in proportion to their importance to the physical officer and to his effectiveness, to have a very appreciable value in his multiple, as they will have in his ultimate value to the service.

(2) *Mathematics.*—To include all mathematics under one head and one set of instructors and with one subject following another in natural order—not as now detached and cut up so that a second classman doesn't know that mechanics is mathematics or that he worked time sights, azimuths, great circle sailing, etc., under the name of "Stereographic Projections" when a third classman. As to deviation of the compass, it will fit in in this department as its *theory* involves nothing but the composition and resolution of forces and the determination of their relative values under different conditions. The practical adjustment of compasses would be taught at drills and on cruises under the next department.

(3) *Ordnance, Navigation and Seamanship.*—This department would give all instruction in theoretical ordnance and seamanship (and may be navigation), all practical instruction in seamanship, ordnance and navigation at drills and on cruises.

The head of department would have command at all nautical drills aboard ship, in boats, etc. The instructors would be instructors on cruises in all subjects under this department.

(4) *Marine Engineering and Naval Architecture.*—The course in this department now covers about 930 hours out of the 1100 allotted to the strictly technical courses of the old cadet engineer course. By modernizing the plant, getting working models from which midshipmen could learn the practice of to-day, as well as the "History of Marine Engines and Boilers" (which can be learned from the models now on hand); by having modern ships with modern machinery for practice cruises and drill periods, on board which the practical parts of both the above subjects (except shop-work) can be learned by actual work and study; by the work done in mechanical drawing during the first summer (this would amount to 10 hours a week for 14 weeks—a total of 140 hours gained); by all the practical work and instruction being shifted to cruises and drill periods; by all these changes and by assigning the time gained to the necessary advance work needed for graduation—the midshipman of to-day will have had as many hours devoted to strictly technical subjects—both theory and practice—as had the cadet engineers of the much lauded course given up on the passage of the Act of August 5, 1882.

In the discussion of the Personnel Bill and its results, it is the proper thing to cite this course as something unattainable under present conditions. The writer yields to no one in his admiration of the method of securing these cadet engineers, the course they studied, nor the splendid engineers they have since become, but, as one of the ablest of these men put it to me, some time since, while discussing the present course, etc., "One would imagine to hear some of this talk that we (meaning the cadet engineers) were all 'designing engineers' the day we graduated! As a matter of fact every one of us, entitled to be called a designing engineer, has hammered out his knowledge in real practical work over the drawing board in the Bureau, at the Academy, at some navy yard or ship-building plant, and given *like material* and shake up the course a very little in certain directions we can turn out graduates equal to the best that ever got a diploma from the Academy."

The course in naval architecture should be worthy of the personal attention of a naval constructor for a part of a term at the Academy, and of the personal attention of the superintending constructors at navy yards and ship yards when midshipmen,

on their practice cruises, visit these places. All practical work confined to cruises and drill periods under the instructors belonging to this department.

(5) *English, History and Law.*—The course of instruction under this department is now confined to the fourth-class year.

(6) *Modern Languages.*—An American naval officer *should* know French and Spanish. Some do. I cannot now recall one who learned either language at the Academy. All should certainly be grounded in both so that the study can be continued after graduation.

(7) *Physics, Chemistry and Electricity.*—The theoretical work in this department is all that the time will allow. The practical work in electricity can to advantage be extended on cruises and in drill periods. If the plan of the chief engineer being in charge of *all* motors on board ship be adopted the practical instruction in electricity should be transferred to the Department of Marine Engineering and Naval Architecture.

The changes given above in the theoretical instruction at the Academy and all practical work being transferred to drill periods and practice cruises would necessitate a complete change in the methods and work on the cruises.

For the fourth class summer and cruise the writer thinks that small brigs, of the general type suggested by Lieutenant Beach in his article on the training system, would give the best results and that the one month's cruise should be in Chesapeake Bay.

For the third class cruise, vessels with two-thirds sail power and auxiliary steam should be provided, and this cruise should be a "Deep Sea Cruise"—the midshipmen to do duty on deck and in the engine and fire-rooms. On this cruise the sailing seamanship should be completed. The duties on deck varying from those of a seaman aloft to petty officers of different ratings; mates of decks and hull, midshipman of quarterdeck, officer of forecastle and officer of the deck. Below—fireman, oiler, water-tender, machinist of the watch, midshipman in charge of fire-rooms, engineer of the watch. The instruction in navigation should cover the day's work, dead reckoning, time sights, meridian altitude, the use of Bowditch and the nautical almanac. Practical instruction in *ordnance*, torpedoes, if fitted, and drills with the guns, midshipmen changing stations from the highest number at the gun through all numbers to gun-captain, midshipman of division and officer of division.

The midshipman should learn all the duties of dynamo-tending by actual watch standing.

The practical work in all departments should be preceded by and accompanied with practical lectures illustrated by the plant on board.

This cruise should make these youngsters thoroughly familiar with ship life at sea and should be an excellent initiation into the mysteries of navigation, ordnance, marine and electrical engineering, and should thus make the theoretical work of the next year much more intelligible.

The *second class cruise* should be on board modern cruisers of good size with modern machinery, guns, dynamos, signal outfit, etc., in fact our latest and best cruisers of from three to six thousand tons displacement. The duties performed would be the same as on the third class cruise. The first study should be the ship herself in all the details of her construction and equipment. The drill in handling the ship, her machinery, guns, etc., should be continuous. The studies in practical seamanship, ordnance, navigation, steam, electricity, signals, etc., should go on. The ship should visit all the navy yards on the Atlantic; all the ship yards building men-of-war; the ordnance factory; the proving grounds and the torpedo station, the midshipmen being required to write up each yard and the work being done. Instruction should be by lectures illustrated by the plant available and the work being done.

The first class cruise should be made on battleships. The practice of the duties of an officer in all departments should be carried on continuously. The first study should be the ship, her construction, armor, battery and ammunition supply, machinery, dynamos, signal systems, ventilating system, etc. The drills to be in the handling of the ship, her heavy guns, machinery, etc. Instruction by lectures should be given on seamanship, ordnance, navigation, steam, electricity, torpedoes (if fitted), being an advance on the work done on the second class cruise. The cruising would be comparatively limited—the going from one port to another. On this cruise the advance work on board would consist of the study of a new type of ship and turret guns. The principal subjects of note-book work, lectures, etc., should be coast piloting. The study of methods of attack and defense of say three principal ports—Chesapeake Bay, New

York and Boston—and a study (by inspection) of the coast defenses we now have in these ports. The study of the attack of the same ports and, say, Halifax. I don't mean that an attempt should be made to go into these subjects as is done at the War College, but teach the a, b, c of attack and defense. *If possible have the ship take part with the North Atlantic Squadron in the summer maneuvers.*

As will be noticed, each class is taken on a cruise by itself. This may not have all the advantages of a combined cruise but the gain by having all working along the same line, only one set of students and one set of instructors, and the fact that each class is learning to handle authority (not only the first) more than compensate for the losses. This idea of the separation of classes should be carried out in all drills at the Academy except the battalion infantry, artillery, some of the ship and gun drills during the year (such as fleet tactics, drills under steam, oars or sails, where each class would be assigned to duties of the proper relative importance). This separation of the classes would call for an addition to the organization of the battalion and the writer suggests that each class should have its cadet officers for its proper handling at drills other than those of the whole battalion. In this way the training "in the handling of men" would go on systematically for the whole four years, and by giving the cadet officers billets strictly according to general merit, not their fitness for a particular rate, and rearranging them (in at least the three lower classes) at the end of each term and at the end of the cruise, it would give a much larger number an opportunity to have some practice in the exercise of authority over others, etc., before going out into the service.

The sum of the changes suggested at the Academy lengthens the course by the four and one-half months preliminary work, shifts all of the practical work and instruction to the cruises and drill periods and by making these cruises and drills and the work done then a part of the course, gives the "practical man" a fair chance to compete with the "Book-man," and this *not* "to the injury of the service." The number of departments has been reduced from eleven to seven.

The changes suggested will require no different shore plant than should be in use to-day. They will require the expansion of the new cadet quarters to the architect's original design,

which would accommodate 1440. The increase will require a larger number of officers as instructors and drill-masters. In spite of the fact that we are so terribly short-handed, the very last cut made in the detail of officers to shore duty should be made at the Academy: 1st. Because officers are the only instructors, who, beside the imparting of information on the subject in hand, are at the same time, by precept and example, teaching midshipmen what it means to be an officer. 2nd. Because of the value of study and teaching to the officer himself.

The greatest increase of plant called for would be afloat. This would be large, but when the importance of the work to be done is considered there should be no hesitation in providing it. An approximate estimate of the ships needed to fully work out the above plan for 1440 midshipmen would be, assuming the midshipmen divided as follows among the classes:

Fourth class, 405, 5 small brigs.
Third class (in June), 333, 4 gunboats.
Second class, 355, 3 cruisers.
First class, 352, 2 battleships.

The above would be required for the cruises. Permanently at the Academy should be 3 small brigs, 2 gunboats, 1 cruiser, 1 battleship, at least 6 torpedo boats, at least 3 destroyers, 1 submarine and 1 monitor. With the new channel (as appropriated for) these vessels can be brought to the Academy. With this floating plant many ship drills could be substituted to advantage, for a large per cent of the battalion infantry and artillery which serve to train the cadet officers but are of little practical benefit to the majority of midshipmen, who under the system given would know their manual of arms and marchings as well as is necessary for service. As to the training of cadet officers, class drills will be doing that, daily, throughout four years.

By the plan outlined above the course has become four full academic years of eleven months each, and on graduation day diplomas should be given to at least 350 midshipmen so well grounded in all the duties of a young officer on board ship, on deck and in the engine-room, that they are fairly entitled to and should receive their commissions as ensigns on the same day.

In all our haste to get officers it must constantly be remem-

bered that the requirements for good young officers are different and more varied than ever before and that the full responsibilities of "a watch and division" are given them much sooner (as it should be). For these and other reasons the standard at the Academy should not be lowered under any stress of circumstances short of war. We must still set the standard for the naval schools of the world. The writer has heard the argument that colleges are cutting down their courses and that therefore we can afford to do the same. Has any one heard of any of the law schools, medical schools or technical schools, of good standing, doing anything but require more preparation at entrance and a longer course? In the last twenty years the requirements for entrance have gone up from the certificate from a high school to an A.B. degree or its equivalent, and the course has been extended from two (2) years of six months each to four (4) years of nine (9) months each.

When one looks over the ground to be covered, the experience acquired, in changing a green boy of 18 into a commissioned officer responsible for the safety of from two to eight hundred lives, and a $5,000,000 ship, doesn't four years seem little enough time in which to make the change? We need officers *badly*, but we don't need, nor do we want, *poor material poorly trained!* Better suffer a little longer until good material properly trained can be developed than to fill up with half-seasoned timber that is bound to fail when most needed!

These young officers at graduation are available for responsible duties as watch and division officers, both on deck and in the engine-room. They should be ordered to the smaller ships *in pairs*, and while one is doing duty on deck the other should be on duty as *watch officer* in the engine-room (not that demoralizing, time-wasting farce of "under instruction"—make him his *own instructor* and hold *him* responsible for the results!). By taking the deck and engine-room alternately for periods of six months; by being required to keep a professional journal (*not a logbook!*) and a fair amount of navigation work, they will be ready at the end of the cruise (3 years) to go up for a professional examination for promotion to lieutenant (J. G.). This examination should be thorough and severe and should be taken by the whole class, *as a class*, and should, in combination with the record of marks (quarterly) made aboard ship during

the cruise, be treated as the "Final Examination" now is—that is, it should be given a proper coefficient, say 3, and combined with the standing at graduation with a coefficient of, say 4, and the whole class rearranged in the order of the new multiples. This gives the practical value of the young officer aboard ship a proportional weight with his theoretical value as determined at the Academy.

After three months' leave this class should again be ordered to sea, still in pairs, the first half of the cruise on the larger cruisers, the last half (if possible) on armored cruisers and battleships. The alternating of deck and engine-room duty to continue. On the completion of this cruise and after three months' leave, the class, *as a class*, should be given their first shore duty in the form of courses of instruction at the torpedo station, ordnance factory, proving ground, compass office, observatory (for chronometer work), engineering experimental station to be established at the old proving ground, the navy yards for shipbuilding and repairs, docking, electric outfitting, etc.

Now, after four years as lieutenant (J. G.), the class should go up for examination for promotion to lieutenants. The examination and the records of the four years, with a coefficient of, say 4, to be combined with the Academy course (coefficient 4), examination for lieutenant (J. G.) and record as ensign (coefficient 3) to determine the order of rank as lieutenants.

These officers are now ready for *any and all* duties to which they are likely to be assigned aboard a fighting ship of any type.

The writer realizes that there will be many criticisms of the competitive system being carried beyond graduation, but he believes it can be done with great benefit to the service and it seems unfair to him to allow the four years' work of a class of boys to determine relative values for all time. (I believe that the competitive system should continue to and through the examination for promotion to commander—after that—well in the end it will I fear be some form of "selection" less just than that based on examination and record.)

As to the time taken under the above system, the average age at entrance is 18, at graduation 22, promotion to lieutenant (J. G.) 25, Lieutenant at 30, or, in about 11½ years from date of entrance (for some about 10½) these officers' early professional ... have been completed. During this time

they have actually been aboard ship six (6) years and ten (10) months, for six years of which time they have been performing all the duties of their grade in actual service conditions.

With this course and under these conditions we have them at thirty holding a responsible rank somewhere near that held by officers of the same age in other services and certainly the equal in training and education of the officers of like age and rank in any naval service in the world. The writer believes that officers selected, trained and educated under the above system will be better all around naval officers *for the conditions in a modern navy* than any ever before trained for our own, or now being trained for any other navy.

300,000,000 men who have neither to be clothed nor fed—an aggregate about forty times as great as that made up by the persons actually engaged in manufactures in the United States. When we estimate the corresponding increase in manufacturing power going on in other quarters, should we wonder at the almost world-wide struggle now being made for commercial expansion? You students of the art of war well know that the struggle to control commerce, the fight to secure places in which to trade, has been and must ever continue to be the greatest of the war-producing factors that precipitate the conflicts of nations. As commerce moves largely on the sea, the armies of the sea rather than the armies of the land must determine where the sovereignty of trade shall abide. The emphasis given by one of your own number, the illustrious Captain Mahan, to the importance of sea-power represents an invaluable contribution to the history of mankind. If, then, the struggle for commercial expansion is to be accelerated by the ever-widening alliance between coal and the steam engine, and if, out of the struggle thus carried on, fresh causes of war must continually arise, is it hard to perceive the reasons why the greatest of the coal-owning nations should build up and maintain a sea-power equal to its commercial importance?

Increasing Necessity for International Law.

I have indulged in these preliminary reflections simply to emphasize the fact that the inevitable increase in the causes of war which must result from commercial expansion, and the rapid increase in the instruments of war consequent upon that apprehension, make it more necessary than ever before that the family of nations should do its utmost to perfect the means by which its conflicts may be referred to some other arbiter than arms. Above the dark horizon about us, clouded on every hand by growing armaments by land and sea, there is rising a star which stood not long ago over a "house in the woods," a house in which was formulated for the first time in history a comprehensive and promising scheme of international arbitration—the child of modern international law. It is a hopeful sign for the peace of the world that while you students of naval science are being trained in the use of the terrible engines of war, you are, at the same moment, being instructed in a system of rules de-

signed to render their use unnecessary. The members of this college are required by its rules to engage not only in the study of actual war problems but also in the study of diplomacy and the law of nations. I feel, therefore, that we can meet to-day on common ground to discuss the origin and growth of a system in which we have a common interest.

The Historical Method.

I am happy to observe that the historical method has a place in your courses of instruction, that you are inclined to reach conclusions as to existing conditions only after comprehensive statistical and historical reviews of conditions existing in the past. Encouraged by that fact I shall attempt, within the narrow limits at my command, to lay before you a brief outline of the process of evolution through which the existing system of international law has reached its present stage of development. There are two great factors in the problem to be worked out. In the first place, we must comprehend the meaning of the phrase, "the family of nations"; in the second, we must grasp the process of growth through which the system of rules regulating the relations of the states composing that family came into existence. What do we mean when we speak of the family of nations? When did it originate? Where does it abide? What does it embrace? Among all the marvels of the fruitful century which has just drawn to a close, there is not one which should fill us with more wonder and admiration than that embodied in the discovery of the historical scholars who have demonstrated the unity of all human history as the record of social and political phenomena whose progressive development has been regulated by permanent, uniform, and universal law. There is no fact that stands in isolation; there is no institution that is not the natural outcome of its antecedents. In the light of that truth students of the historical school, when they are called upon to deal with an institution, social or political, invariably begin with its germs in primitive society, and then explain its nature and meaning through the record of its development. Only by the aid of that process is it possible to grasp the comprehensive thought embodied in the phrase, "the family of nations." Without some knowledge of its historical antecedents it is impossible to describe the vast political aggregation

of states which shelters within its fold the civilized nations of the earth to-day.

THE ANCIENT STATE AS THE CITY COMMONWEALTH.

As employed in modern times, the word "state" presents to the mind a political conception which a statesman of the ancient world could hardly have grasped, for the reason that the political organization we call the state had in the ancient world no existence. If you could sever the city of Newport from the State of Rhode Island, from the federal republic of the United States, and then clothe it in its isolation with full sovereignty, with the right to make peace and war and treaties with foreign powers, you would have a complete conception of the state as known to Thucydides and Polybius, to Livy and Tacitus—the state as defined in ancient international law. During the earlier and more brilliant days of Greek history the independent city-commonwealth, and nothing higher or lower, was the one acknowledged political unit which every Greek citizen regarded as his country. Within the narrow and exclusive limits of its walls his self-centered patriotism was confined. When we pass from the Greek to the Italian peninsula we there also find the idea of the independent city to be the dominant political idea. Upon the soil of Italy it was that a group of village communities grew into a single vast and independent city that centralized within its walls the political government of the world. That marvellous result was accomplished through a policy of incorporation carried out through the extension of the Roman franchise, first to Italy, then to Gaul and Spain, and finally to the whole Roman world. In the end a right so widely bestowed became of course utterly worthless, but the theory upon which it was conferred was never for a moment lost sight of. The freeman who received the franchise of the Roman city could enjoy it only within her own walls; it was only within the local limits of the ruling city that the supreme powers of the state could be exercised. And so whether we take for illustration the exclusive Greek city, or the great Latin city, extending its franchise to all the world, the ancient conception of the state as the city-commonwealth stands forth clearly and distinctly defined.

Origin and Nature of the Jus Gentium.

Rome's priceless legacy to modern international law is represented by the *jus gentium* which, as employed by her, was not international law at all as that term is now understood. According to ancient legal ideas the law of one city had no application to the citizens of another. What was known at Rome as the *jus civile* was a city code made up of the immemorial customs and usages which were the special property of Roman citizens as such. It was a personal law administered by the *praetor urbanus* between Roman and Roman; it had no application between a Roman and a foreigner. As a large colony of resident foreigners finally gathered at Rome, it became necessary to remedy that condition of things through the creation of a *praetor peregrinus*, the praetor of foreigners, whose duty it was to administer justice between Roman citizens and foreigners, between foreigner and foreigner, and between citizens of different cities within the Empire. As such praetor could not rely upon the law of any one city for the criteria of his judgments, he naturally turned his eyes to the codes of all the cities from which came the swarm of litigants before him. In the generalizations necessarily made upon such broad data we have the beginnings of comparative jurisprudence, whose first fruit at Rome was the ascertainment of the fact that there are certain universal and uniform conceptions of justice common to all civilized peoples. Out of that discovery arose the new creation known as the *jus gentium*, a creation to which Cicero referred when he said, "it is not one law for Rome and another law for Athens, one law to-day and another law to-morrow, but one eternal and universal law, for all times and all peoples, as God himself is one." * Before this new growth, watered by the learning of the jurisconsults, reached its maturity, the intellectual life of Rome passed under the dominion of her subjects in Attica and Peloponnesus, just after they had yielded to the ascendency of the Stoic philosophers who were ever striving to discover in the operations of nature, physical, moral, and intellectual, some uniform and universal

* Non erit alia lex Romæ, alia Athenis, alia nunc, alia posthac; sed et omnes gentes et omni tempore una lex, et sempiterna, et immortalis, continebit, unusque erit communis quasi magister et imperator omnium Deus. Fragm. *lib.* iii, *de Repub.*

force pervading all things, which could be designated as the law of nature—the embodiment of universal reason—identical with Zeus, the supreme administrator of the universe. Through the mind of the Roman lawyer that splendid conception entered into the *jus gentium* as an expanding and enduring force which finally lifted it into a higher sphere. Thus it was that a broad principle of Greek philosophy became so blended with a particular branch of Roman commercial law that the Antonine jurisconsults finally assumed the position that the *jus gentium* and the *jus naturae* were identical. Such, in short, was the origin and nature of that branch of Roman private law, whose distinctive feature was its limitation to the legal relations of individual foreigners resident at Rome; it had nothing whatever to do with the relation of states with states. Only with that fact firmly in hand will it be possible to estimate, later on, the importance of the transition which took place when Ayala, Gentilis and Grotius seized upon the *jus gentium* as the source from which could be drawn rules adequate to determine the jural and moral relations of a group of sovereign, co-equal and independent states.

The Modern State as the Nation.

Out of the settlements made by the Teutonic nations upon the wreck of the Roman Empire has gradually arisen the modern conception of the state as a nation occupying a definite area of territory with fixed geographical boundaries—the state as known to modern international law. At the time Tacitus wrote, the typical Teutonic tribe was a distinct commonwealth, the largest and highest political aggregate. Not until nearly a hundred years later were these scattered tribes gathered into larger wholes, into nations. And here the fact must be emphasized that such nations were migratory nations; at this stage of their development the idea of sovereignty was not associated in the mind of the Teutons with dominion over any particular part of the earth's surface. The Merovingian line of chieftains were not kings of France, they were kings of the Franks. Alaric was king of the Goths wherever the Goths happened to be, whether upon the banks of the Tiber, the Tagus, or the Danube. In other words, every Teutonic nation was then organized for war purposes, and was thus, in the current phrase of to-day, a "flying squadron." The dominant idea that seems to have

prevailed among these conquering nations after they had settled down on the wreck of Rome was that they were simply encamped on the land they had won. In the course of time they became tied to the land through a process which, for the want of a better term, has been called "the process of feudalization." In that way the elective chief of a once migratory nation was gradually transformed into the hereditary lord of a given area of land. The new conception of territorial sovereignty which thus arose out of "the process of feudalization" did not become dominant, however, until after the breaking up of the Empire of Charles the Great, out of the fragments of which arose most of the states of modern Europe. The completion of the transition from personal to territorial sovereignty is marked by the accession of the Capetian dynasty in France. Hugh Capet and his descendants were kings in the new territorial sense; they were kings who stood in the same relation to the land over which they ruled as a baron to his estate, the tenant to his freehold. The form thus assumed by the monarchy in France was reproduced in each subsequent dominion established or consolidated, and thus has arisen the state system of modern Europe, in which the idea of territorial sovereignty is the basis of all international relations.

The Medieval Empire as an International Power.

The separate nationalities which thus arose out of the wreck of the empire of Charles the Great passed through a long childhood under the protecting wings of an institution that illustrated for centuries the enduring power of a political theory. The two great ideas which expiring antiquity bequeathed to the ages that followed were those of a world-monarchy and a world-religion. By those ideas the Teutonic conquerors of Rome were so overmastered that they came to believe that as the dominion of Rome was universal, so must it be eternal. Out of such belief gradually arose the strange creation known as the Holy Roman Empire, which rested upon the magnificent notion of a vast Christian monarchy whose sway was absolutely universal. The chiefs of that comprehensive society were the Roman Emperor and the Roman Pontiff—the one standing at its head in its temporal character as an empire, the other standing at its head in its spiritual character as a church. But as

the Pope conferred the imperial dignity by consecration, he finally claimed to be the ultimate judge of the Emperor's acts, with the power of deprivation and deposition. The judicial supremacy thus claimed by the Pope, not only over the Emperor, but over all other Christian princes, taking its color from the dominant political idea of the age, naturally assumed a feudal shape. The theory was that all Christian princes stood to the Roman Pontiff as great vassals to a supreme lord or suzerain; and as such suzerain the Pope claimed the right to act as supreme judge in all grave affairs of his vassals, whether national or international. Thus, for centuries, the medieval empire stood forth as the one bond of cohesion, holding Europe together under the spell of a theory that assumed to provide a complete system of international justice, and a supreme tribunal adequate for the settlement of all controversies which could possibly arise between Christian nations. No matter whether the medieval empire was a theory or an institution, not until the splendid conception of a united Christendom it embodied was wrecked in the storm of the Reformation, was the field cleared for the growth of international law as now understood.

Creation of the Modern International System.

The great earthquake that began in Germany struck at the very root of the theory by which the empire had been created and upheld—the theory that all Christendom consisted of a single body of the faithful held together under the dominion of the Eternal City ruling through her spiritual head, the Bishop of Rome, and through her temporal head, the Emperor. Not until the collapse of that ancient and imposing theory of a common and irresistible superior did the emancipated nationalities, which had crouched so long at its feet, begin to realize, first, that each state is sovereign and independent, and as such co-equal with all the rest; second, that territory and jurisdiction are co-extensive. Grotius, clearly perceiving these simple truths, emphasized the fact of the independence of the sovereign states about him by formally repudiating the obsolete doctrine of a temporal and spiritual head of Christendom armed with the right to exact universal obedience. His primary contention was that each state is absolutely independent of all external human authority. Having thus established a common basis of equality,

the difficulty that remained was how to subject sovereign states, through their own volition, to the yoke of legality. No more novel or difficult problem was ever presented for solution than that which confronted the publicists of the sixteenth and seventeenth centuries when they were called upon to formulate rules adequate, by virtue of their intrinsic weight and dignity, to compel the obedience of the freshly emancipated European nationalities, without the coercive force of any recognized central authority. Imitation being always easier than invention, it is not strange that every mind that attempted to solve the problem should have turned instinctively to Roman jurisprudence as the only source from which the vacuum could be filled. As explained heretofore, the most comprehensive, the most philosophical branch of Roman law was that known as the *jus gentium* —not a body of rules that regulated the relations existing between states as corporations, but a branch of Roman commercial law applied where foreigners were concerned. To Grotius more than to any other one is due the credit of having utilized the *jus gentium* as a reservoir of principles from which were drawn the beginnings of the rules that now regulate the relations of the states composing the family of nations.

THE CONCERT OF EUROPE.

The first diplomatic congress in which the sovereign states of Europe ever assembled was that which concluded, in 1648, the famous Peace of Westphalia, whereby the conflict that had convulsed Germany for more than a century was definitely closed at the end of the Thirty Years' War, in the two treaties signed at Münster and Osnabrück. In those treaties was embodied a general settlement that survived without a break as the basis of the public law of Europe down to the French Revolution. The underlying motive of that settlement was the creating of such a concert of action between the greater states as would preserve what has since been known as the balance of power. According to the Grotian theory, which the Peace of Westphalia frankly recognized, all states, great and small, are, as territorial sovereigns, co-equal before the law of nations. Within its own territory each is supreme; territory and jurisdiction are co-extensive. And yet, despite those plain provisions of the written code, there has grown up alongside of it a set of

tacit understandings which have subordinated the legal rights of the theoretically equal European states to a higher law upon whose authority rests the primacy or overlordship vested in the powers that now constitute the Concert of Europe. That primacy or overlordship, gradually developed outside of the written treaty law since the Peace of Westphalia, represents the common superior who actually succeeded to the place made vacant by the collapse of the medieval empire as an international power. With the advent of the eighteenth century the European Concert —made up, in the main, prior to that time, of France, Spain, Austria, Sweden, Holland and England—was widened by the addition of new elements that entirely changed the politics of the world. Such elements were represented by the new empire of Russia, built up in the north by the genius of Peter the Great and Catherine; by the powerful and independent kingdom of Prussia, lifted from a secondary place in the German Empire by the military ambition of Frederick II; and by the colonial possessions of Great Britain, France, Spain, Portugal and Holland in the continents of America and Asia, and in the eastern and western isles. The famous Peace of Paris, signed in 1763 by the four powers first named, for the purpose of concluding the world-wide contest made possible by reason of their colonial dominions, marked a transition from a condition of things in which the relative weight of European states had depended entirely upon their possessions within Europe itself. The world had learned already that wars begun within the limits of Europe might have to be fought out upon the banks of the Ganges and the St. Lawrence.

The United States and the Monroe Doctrine.

Before the American Revolution ended, the Congress of the United States, which, under the Articles of Confederation, possessed jurisdiction over all international questions, professed, in the ordinance of December 14, 1781, obedience to the law of nations "according to the general usages of Europe." When the torch thus lighted in the West was passed on to those who kindled the fires of the French Revolution, the Concert of Europe reassembled in order to apply to the internal affairs of France the same principles of intervention which it had so recently applied with deadly effect in the case of Poland. Inter-

ference was justified by the declaration that monarchical institutions everywhere were endangered by revolutionary principles that threatened to extend from France to all other countries. To prevent that result the Concert undertook to intervene upon a vast scale, and in the end the intervention was successful. Napoleon was crushed and the throne of France restored to the House of Bourbon. But before the end came the ancient diplomatic fabric of Europe was shattered. Old landmarks were swept away; many of the smaller states were annihilated and some new ones created. The mighty task of reconstruction thus made necessary was committed to the famous congress that assembled at Vienna in November, 1815, the most important diplomatic body that had met since the Peace of Westphalia, a body which relaid the foundations of public law and restored to Europe a period of repose not seriously disturbed for forty years. The unusually intimate relations between a few of the greater powers, resulting from their joint intervention in the affairs of France, seem to have suggested to the Czar the idea of uniting Russia, Austria, and Prussia in the mystic bonds of a Holy Alliance, whose primary purpose was to protect the principle of legitimacy against the then powerful tide of popular freedom by which it was threatened. I shall not pause even to outline the history of the attempt of the Holy Alliance to extend its interference to the affairs of this hemisphere. Suffice it to say that when Monroe went to Jefferson and placed in his strong hands the task of defining the place of the New World in the family of nations, the sage of Monticello solved the mighty problem involved with that sententious simplicity that ever characterizes the utterances of the great. In its essence his famous declaration was this: The Concert of Europe must never be permitted to interfere in the affairs of America, North or South, because "America has a set of interests distinct from those of Europe, and peculiarly her own. She should therefore have a system of her own, separate and apart from that of Europe." The brief outline of the new American system thus drawn by Jefferson, after receiving the endorsement of Madison, passed to the Congress of the United States through President Monroe as a conduit, and in passing took his name.

But let us remember here that the Monroe Doctrine, like every other institution that has been the result of growth, did

not attain its full stature in a night; it did not spring into life fully armed. Its present dimensions are the result of seventy-five years of persistent development, worked out by the pens of successive presidents and secretaries of state. By President Polk's protest against future European colonization in this hemisphere, made in the face of possible European intervention on account of the annexation of Texas, President Monroe's original statement was greatly widened; and when, in 1865, it became necessary for President Johnson to notify the emperor of the French that this country could no longer tolerate armed intervention in the affairs of Mexico, it was given a deeper meaning and a stronger significance. Not, however, until a resolute and far-sighted statesman, who clearly understood that our marvellous natural development entitled us to rank as a world-power, was given the opportunity by the boundary controversy between Great Britain and the Republic of Venezuela, was the inevitable declaration finally made that the same reasons that impel the Concert of Europe to guard the balance of power in the old world prompt the Government of the United States to maintain alone its primacy in the new. From the hand of President Cleveland the Monroe Doctrine first received complete and scientific definition; and when the Government of Great Britain justly and wisely conceded the right of arbitration then asserted by the United States, solely by virtue of its primacy or overlordship, a final settlement was made of the place of this Republic in the family of nations, and the foundations laid for that close moral alliance since developed between the two broad divisions of English-speaking peoples. If the Monroe Doctrine, as thus expounded, is not already a part of the international law of the world, it is rapidly tending in that direction. As an eminent English publicist has lately expressed it: "The great powers of Europe, as they are called, have gradually obtained such a predominant position as to render untenable the position that there is no distinction between them and other sovereign states; and the position they hold in Europe is held by the United States on the American continent. . . . The great Republic of the New World stands out like a giant among pigmies. There is no other state in the same hemisphere which can be compared to her in strength and influence. . . . The supremacy of a committee of states and the supremacy of a

single state cannot be exercised in the same manner. What in Europe is done after long and tedious negotiations and much discussion between representatives of no less than six countries, can be done in America by the decision of one Cabinet discussing in secret at Washington."

The Era of Humanity.

As our subject draws to a close, it is a comfort to be able to glorify the fact that, in our own time, international law has become so imbued with the Christian spirit of humanity that its primary purposes now are: first, to render all wars unnecessary through the good offices of international arbitration; second, to provide for the greatest possible mitigation of the horrors of war, after the means of conciliation have proven ineffectual. The plenipotentiaries who concluded the Peace of Paris, 1856, were made to feel that the time had come when the increasing outcry for the introduction of greater humanity into the rules and practices of war could be disregarded no longer. In obedience to that demand the question of the maritime rights of belligerents and neutrals was formally presented to the Congress, and the result was the Declaration of Paris, a protocol signed April 16 by all the parties represented, and subsequently accepted as a part of the public law of the world by all powers except the United States, Spain and Mexico. The first great step thus taken was soon followed by the notable act of President Lincoln who, in 1863, requested Prof. Francis Lieber of Columbia University in the city of New York, to undertake the no less novel than humane task of codifying the laws of war. In the very next year, really in response to the appeal made by two citizens of Geneva—Dunant, a physician who published a startling story of what he had seen in the hospitals on the battlefield of Solferino, and his friend, Moynier, who conceived the idea of "neutralizing the sick wagons"—met the famous body composed of the representatives of the fourteen states who signed, on August 22, 1864, the Convention of Geneva, regulating the treatment of the sick and wounded, and neutralizing all persons and things employed in their service, such as surgeons, chaplains, nurses, hospitals and ambulances, provided such persons and things are distinguished by a badge or a red cross on a white ground displayed on an arm or on a

flag, as the case may be. In order to revise and extend the original provisions another Convention was signed at Geneva, 1868, but never ratified, whose Additional Articles, including the neutralization of hospital ships, relate chiefly, though not exclusively, to warfare at sea. Less than two months thereafter a Military Commission at St. Petersburg, composed of delegates from seventeen states, including representatives from Persia and Turkey, agreed as between themselves "to renounce the employment of any projectile, on land or sea, of a weight below four hundred grammes (fourteen ounces), which should be explosible or loaded with fulminating or inflammable materials." In the Declaration then made it was said that the object of the use of weapons in war is "to disable the greatest possible number of men, that this object would be exceeded by the employment of arms which needlessly aggravate the sufferings of disabled men, or render their death inevitable, and that the employment of such arms would therefore be contrary to the laws of humanity." In 1874 met the Conference of Brussels, in which appeared the representatives of all the European powers of any importance, in the hope of bringing about the adoption by all civilized states of a common code for the regulation of warfare on land. As the delegates were not plenipotentiaries, the Conference was purely consultative; and the outcome was a series of articles embodied in a Declaration which remained as the basis for further negotiations between the governments concerned. In 1877 met the Conference of Constantinople which vainly endeavored to obtain from the Porte guarantees for the better government of its Christian subjects; in 1884-85, the West African Conference of Berlin, whose purpose was to regulate the affairs of that region, including the boundaries and independence of the Congo Free State; and in 1890, the Conference of Brussels, which resulted in the Final Act for the suppression of the African slave trade.

Such were the worthy preludes to the meeting of the International Conference of Peace, proposed and summoned by the Czar of Russia, in which assembled at The Hague on the 18th of May, 1899, an hundred delegates from twenty-six powers—twenty European, four Asiatic, and two American. At a very early stage in the proceedings of an assembly called by the chief of the great empire of the east of Europe, the first plenipo-

tentiary of the great empire of the west, Sir Julian Pauncefote, formally proposed, in a remarkable *mémoire*, the question of the creation of a permanent tribunal of arbitration. The delegates of the United States submitted at the same time a similar proposition, expressing the desire that arbitration might become a normal method of adjusting international disputes. While the delegates of the German Empire objected, and no doubt wisely, to obligatory arbitration as a step too far in advance of existing conditions, they subsequently expressed the cordial adherence of Germany to a voluntary international court, Prof. Zorn declaring that his government "fully recognized the importance and grandeur of the new institution." The strength of the Conference was in its patience and moderation; in its indisposition to attempt to go too far beyond the limits of the world's experience. Its members perfectly understood that every viable constitution must be the natural outcome of progressive history; that it must be the result of the welding together of pre-existing elements just at the moment when such elements are being impelled toward union by their own momentum. Only because the statesmen and publicists who met at The Hague for the purpose of laying the foundations of a federal constitution for the United States of the World were guided by that all-important truth, is there any hope whatever that the results of their labors will endure as a permanent and cohesive force. Let us follow in their footsteps, content to press on just as fast and no faster than the world's progress will permit the substitution of the reign of law for the reign of arms. Not until these United States of America had dwelt together for a time in the really voluntary bonds known as the Articles of Confederation, were they content to submit to the sovereign and coercive authority of the existing constitution. So let us hope that the United States of the World, after they have been convinced by experience of the inadequacy of voluntary arbitration, helpful as it is, will be content to enter into a more strictly organized system armed with the power to apply obligatory arbitration to every dispute that threatens to inflict the horrors of war upon mankind. The first tentative step in that direction taken in the Pan-American Conference, recently held in the City of Mexico, certainly indicates the fact that, in the New World at least, there is a strong disposition to try the experiment.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

TRAINING OF GUN CAPTAINS.

By Lieut. Walter S. Turpin, U. S. Navy.

" In time of peace prepare for war " is a saying which is most appropriate to the conditions existing in a naval service, where we have placed, in time of peace, mighty engines of war with which we are expected, in time of war, to achieve mighty results. If we are to justify the trust placed in us we must utilize the time we have at our disposal, to the best advantage in preparing our weapons for the ultimate test.

This preparation has many subdivisions, but one of the most important is learning to shoot straight. This straight shooting depends on the training we give the men who are to handle the guns and it is with the object in view of devising the best method of training that this paper is written.

It is not supposed for a moment that the method here proposed cannot be improved, but the more views on the subject we have the more certain will we be that the method we finally select will be the best.

The duties to be performed by gun captains are of two kinds and those duties are of such a nature that one man cannot perform them both and, at the same time, make the service and firing of the gun efficient. Since there are two distinct sets of duties to be performed by men who might be called " Gun Captains," the use of titles, which describe these duties, seems advisable in order that no confusion may result when reference is made to them.

First of all a statement of these duties is necessary, then titles, which seem suitable, may be assigned.

One set of duties consists in pointing and firing the gun. The

man whose duty it is to point and fire the gun may suitably be called the " Gun Pointer."

The other set of duties consists of superintending the loading of the gun and in the general supervision of the crew. This man may suitably be called " Gun Captain."

That these duties cannot be combined without great loss of efficiency, is evident, for the gun pointer must give all his attention to his duty of pointing the gun and any duty which tends to distract his attention is to be avoided. For a like reason the gun captain should not be required to point the gun except in the case of emergency.

Throughout this paper I propose to use the terms " Gun Pointer " and " Gun Captain " only in the sense in which I have defined them.

Before discussing the nature of the training, the place to be used for this training should be selected. Shall we train the men on ships regularly commissioned for that purpose or shall the training be done on the ships commissioned for general service? The best answer to that question is yes and no; it is a success in so far that the men graduated know their duties and are, as a rule, good gun pointers, but it is a failure in so far that the number of men graduated is so much below the number required as to be a mere drop in the bucket. That this deficiency is due to the fact that we have at present only one training ship, only goes to prove that our training facilities must be increased. How then shall we increase these facilities? By increasing the number of training ships or by training the men on the regular cruising ships? If we are able to obtain equally good results from both systems, and I see no reason why we should not, then train the men on board the regular cruising ships if for no other reason than that we get the services of the men during their term of training.

There is, however, an additional reason for training the men on board the regular cruising ships, and this reason is that in order to get the best results from any system of training the interest of the men must be aroused and a spirit of rivalry engendered. That this spirit of rivalry can be awakened on board training ships is very questionable, but that it can and has been done, not only between various ships, but also between guns' crews of the same ships, is certain. A very notable ex-

ample of the success of training men on board cruising ships is shown by the results obtained on board H. M. S. Terrible, and in my opinion not a little of this success was due to the interest taken by the men under training and their efforts to be the best.

Record practice with prizes and the results to be published would be of inestimable value in awakening the necessary interest.

Gun Pointers.

In all occupations and trades there are men who are better than others. Some men are natural mechanics or natural mathematicians, so also some men are naturally good shots, and from these men we should expect to find our good gun pointers. How then shall we select, from the men available, these naturally good shots? The simplest and least expensive method is to look up the small-arm firing records, or better still, to have small-arm target practice and instruction for all the available men and let this be a preliminary course of instruction for gun pointers. This practice should not merely consist of firing a single string of shots for a record, but should be more in the nature of a weeding out process, and should be held somewhat as follows: Let every available man in a ship fire a string of shots under the personal supervision of a competent instructor. Tabulate the results and select from those who have made the best scores, twice as many men as are needed for gun pointers. Continue this process of weeding out until you have the best shots, not by averaging the results alone, but also taking into consideration the regularity with which a man shoots. This last consideration is a very important one from the fact that reliability is very desirable in a gun pointer.

The selection of candidates having been made, the course of training remains to be given.

After the preliminary training and selection the first step is to assign the various candidates to the guns it is intended that they should point. This assignment should be permanent and nothing but the most important consideration should change it. If it becomes necessary to make a change it should not be a radical one, as for instance from a 6-pounder to an 8-inch gun, but if possible from one 6-pounder to another or from one 8-inch or 13-inch to another 8-inch or 13-inch. The reason for laying

such stress on this point is that the value of a knowledge of the peculiarities, or you might say "the personal equation of the gun," to the gun pointer cannot be over-estimated. The small-arm sharp-shooter invariably uses the same rifle, and there is no good reason why a great-gun sharp-shooter, if I may use the term, should not do the same. Undoubtedly a sharp-shooter will do good shooting using most any rifle, but he will do the best with the rifle he is accustomed to firing.

The further training may be divided into four parts as follows:

1. Adjustment and use of sights.
2. Laying of gun.
3. Working of mechanism.
4. Corrections of errors from knowledge of fall of previous shot.

1. Telescopic sights are liable to need adjustment from time to time and the gun pointer should be thoroughly instructed in how to make this adjustment.

Instruction must also be given in the use of sights and for what the various wires and devices are. First of all an explanation of the principle of the sight should be given. What is meant by the full, half, and fine sight, and the use of the sliding leaf, and in telescopic sights the effect of bringing the target on either of the vertical wires and in between them. This instruction may be given practically by the use of a subcalibre attachment. Point the gun at a fixed target exactly between the vertical wires in the telescopic sight and fire, noting where the shot strikes, then do the same thing bringing the target on the left vertical wire, noting in each case the fall of the shot relative to the target. Go through the same operation with the bar sights but instead of bringing the target on one or the other of the vertical wires use the sliding leaf. The effect of taking a fine, half or full sight can be shown in a similar manner.

2. After the gun pointer is familiar with the sight and the uses of its various attachments the next step in the training is to teach him to lay his gun properly. Some instruction has been given in this by teaching the use of the sight, but additional instruction can be given by subcalibre practice at a target whose range is known accurately.

3. Teaching the use of the elevating wheel is very important, for on its rapid use depends in a great measure the rapidity of

the fire. This instruction must be progressive, that is, the gun pointer must first be instructed to lay the gun on a stationary target. There are several methods available for this instruction, all of them have their uses. First, the gun pointer should be taught to keep the gun horizontal by constant practice at keeping the gun on the horizon. The next step is to teach him to change his elevation quickly by constant practice with a device similar to Captain Scott's "Dotter." Another means, if there is any motion on the ship, is subcalibre practice. This practice will give the necessary rapidity, for the loading interval with the subcalibre attachment is very small. Connection should be made so that the gun pointer fires the gun, and provision must be made for a trainer to train the gun. Of the three things the gun pointer may do, the two most important are the elevating and firing of the gun, hence the need of a trainer. This portion of the training requires the longest time and it should not be left too soon and the next step taken up.

4. The next step, that of teaching the gun pointer the "personal equation of the gun" and the corrections to be made from the knowledge of the fall of the shot, can only be had by target practice. To teach him the "personal equation of the gun" firing should be had at a stationary target, the range of which is accurately known. This firing should be very slow and deliberate and not more than one gun should be fired at a time at the same target. The fall of each shot should be noted by the gun pointer. The observation of the fall of the shot not only gives the gun pointer exercise in correcting his pointing but also tells him what he may expect from the gun under given conditions. After a thorough knowledge of the allowances to be made for the gun has been obtained, firing at a moving target, with accurately known ranges, will enable the gun pointer to determine the allowances to be made for the motion of the target. As in the firing, to determine the range allowances the firing should be slow and the fall of shots noted. The object of this firing is not to teach the gun pointer to fire rapidly but to give him a knowledge of the allowances for various conditions, and for that reason the firing should be slow.

The most important lesson to be learned from target firing arises from a condition of things which is almost sure to obtain when firing guns from a movable platform, namely, that of

knowing the range only approximately. It is therefore necessary to teach the gun pointer to correct his range from the observation of the fall of his shots. The best method of doing this is target firing at a target the range of which is only approximately known. As in the firing for teaching all the other corrections, this should be started at a stationary target where the firing can be slow and afterwards a moving target should be used, so that there is not only the error in the original range to be corrected but also the movements of the target between shots.

In the target-practice instruction particular stress has been laid on the necessity of firing slowly. This point is most important for the object of this target practice is primarily to teach the gun pointer how to shoot and rapidity of fire depends largely on the expertness of the gun crews. Practice in rapid pointing can best be obtained by subcalibre work and work with the "dotter."

After the completion of the proposed course of training the gun pointer may be considered to have qualified for the rating, but the fact that he has so qualified should not mean that the exercise should be discontinued. The more practice and exercise he gets, the better gun pointer he will be, and for that reason that part of the instruction which tends to increase the rapidity of the pointing, namely, subcalibre and "dotter" work, should continue.

Gun Captains.

The qualifications necessary to make a good gun captain may be briefly stated as follows: 1. A cool head. 2. A thorough knowledge of the gun and its working parts. 3. A thorough knowledge of the gun mount and its working parts. 4. A knowledge of the ammunition and the means provided for its supply. 5. Some mechanical ability. 6. Ability to handle men. All of these qualifications are important, but with the exception of the first and last two, they can be taught to most any man of average ability. The selection of men to be trained seems to narrow itself down to men who possess a cool head, some mechanical ability, and can handle men. No such method, as that proposed for selecting candidates for gun pointers, can be given, consequently we have to rely on observation. In the working of large turret guns the importance of the gun captain's

duties are second to none, and in cases where good gun pointers are available it seems advisable for the turret officers to perform the duties of gun captain.

The training of a gun captain is a much simpler problem than that of a gun pointer and requires less time. This training may be divided into seven parts, as follows: 1. Guns and gun construction. 2. Mounts. 3. Breech mechanism. 4. Firing attachments. 5. Ammunition. 6. Ammunition supply. 7. Drill book.

1. This part should consist of explaining the kind of gun and its parts and the method of construction.

2. Instruction under this head should consist of teaching the candidate the nomenclature of the mount and the uses of the various parts. This instruction should be of an entirely practical nature and for that reason the gun captain should be made to take every part of the mount to pieces and assemble it until he is thoroughly familiar with it and knows what small defects he is liable to meet under firing conditions.

3. Similar instruction should be given on the breech mechanism, and here again the instruction should be entirely practical.

4. The firing attachment should become thoroughly known. Included in this should be a knowledge of the electric firing circuits, and where breaks and defects are likely to occur also the remedies and tests to be applied. Some elementary knowledge of electricity is desirable.

5. A thorough knowledge of ammunition can be very readily taught and no method need be given.

6. A knowledge of the ammunition supply routes is very desirable and should be one of the things a gun captain should know.

7. The knowledge of the drill book is most important and this can be learned not only by study, but by requiring the gun captain to take charge of the drills of the gun's crew. This is one of the most important portions of the gun captain's training, for on this knowledge and the rapidity with which he is able to get the gun loaded depends very largely the rapidity of fire.

In conclusion, I want to call attention to several points which are of utmost importance and until they are adopted we cannot hope to get even good results. Too much stress cannot be laid on the necessity of keeping the gun pointer at his particular

gun, his duty of pointing the gun is paramount, and just because he happens to be rated a coxswain or something else, he should not be taken away from that gun. With gun captains this is not so important, but it is still important, and when changes are made they should not be radical.

Another point is that we should not begin at the wrong end, so to speak, and a gun pointer should not be advanced from one stage of the training until he is thoroughly proficient in that stage. This is particularly true of the advance from stationary to moving target practice. Stationary practice should be continued until the man can make at least 80 per cent of hits at a fixed target, the range of which is known, then some progress at a moving target may be expected. If a man is not proficient at stationary target practice, moving practice is worse than useless and the ammunition so expended is simply wasted.

Another consideration is that, because a man has once qualified, it should not be assumed that he will always be good. He should be required to keep up his average, and if he does not, someone else who can should be put in his place. For this reason, gun pointer should not be a rating, which requires departmental sanction or a court martial to disrate, but should simply carry with it extra pay terminable at the discretion of the commanding officer.

With the end in view of keeping up the proficiency of the gun pointer, " dotter " practice and subcalibre practice should be kept up all the time.

In the selection of men to train, the small-arm target practice proposed should be held with the men, using an artificial rest if desired, for we want to find the men who know how to shoot, and no consideration such as inability to hold a rifle steady should interfere, for that is a condition with which he does not have to contend in firing a great gun.

There are many things in the construction of our guns and the appliances used on them which could be improved, but that is not within the province of this paper. There is one consideration which has a vital bearing on the subject and that is the routine. The routine should be so arranged that the training of gun pointers and guns' crews should be given its proper prominence, and all drills and exercises which tend to decrease this prominence should be at once eliminated, and in their places substituted gun drills and practical instruction.

Nothing can take the place of actual firing and for that reason the guns' crews should always be on hand at target practice, no matter for what purpose it is held. The advantage to the gun's crew of actually doing the work which they will have to do in actual warfare, cannot be replaced by instruction. In that way the training of the gun captains and gun pointers can be carried on simultaneously.

One very important fact should be borne in mind in any scheme for training, and that is that the ammunition allowed is limited, therefore this allowance should not be divided up among several men, but should be used in perfecting one man rather than giving a smattering to several.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE TRAINING OF LANDSMEN.

By LIEUTENANT-COMMANDER HARRY S. KNAPP, U. S. Navy.

The expansion of our navy in ships has so far outstripped the expansion of the personnel that no more serious question confronts the service than that of manning ships now built or nearing completion; and the question of providing men for the additions to the fleet that are bound to come in the near future only adds to the gravity of the situation. This is my excuse for approaching a subject that has already, in one aspect or another, occupied many recent pages of the PROCEEDINGS, and what follows is offered in the hope of helping toward the solution of a pressing problem.

From the very beginning I have been hopeful of good results from the training of landsmen, and my hope continues. If the work has been carried on so far in a seemingly hap-hazard way, with little or no apparent method or prevision at times, and with inconsistencies and lack of uniformity in the training given, it has doubtless been due in large measure to the necessities of the case, where a new system had to be put into effect with the inadequate appliances at hand and under the control of officers already overburdened with other pressing duties. But the system has been in operation long enough now to have demonstrated its usefulness, and it is time that the service take account of stock, so to speak—find the good points of present methods, eliminate unsuccessful or undesirable features, and, above all, take steps to systematize the work in the future.

Speaking of the recruits themselves, they seem to be, in general, carefully selected and a good class of men. Inevitably a few worthless or incorrigible men will be found in every draft and means should be adopted, as with apprentices, to discharge

such men promptly as soon as their real characters appear. As far as possible this should be done in barracks, but it would be a boon much appreciated if such men could be gotten rid of by commanding officers afloat without the necessity of a reference to Washington. Utmost candor and honesty should be pursued in recruiting in order that men may not be induced to enlist under what they afterwards consider false pretenses. Promises of attractive foreign cruises should not be held out unless they are rigidly adhered to, and men should be told not only what advantages the service offers in the way of advancement but the limitations of those advantages as well. From experience I have every reason to believe that some men have enlisted under very mistaken notions, absolutely unfounded as far as law and regulation go, and yet notions gotten at the recruiting station. No naval officer believes that recruiting officers themselves are the source of such false ideas; but that they have been given by romancing petty officers of recruiting parties there is reason to believe. The recruit when he presents himself is not in a position to weigh the source of information given him; it is all gospel whether it comes from a commissioned or a petty officer, and is always credited to the former.

Before considering the character of training that is desirable it will be well definitcly to formulate the object in view and note the limitations imposed by circumstances.

Probably nobody will find fault with the assertion that the object of the training we are considering is to make a man-of-war's-man. The ideal man-of-war's-man of to-day is as different from his predecessor of a hundred years ago as is the ideal officer from his service ancestor, and training must follow the line of development. Above all things the modern man-of-war's-man must be a courageous man who can *shoot straight and fast*. That is his *raison d'être*. To a greater or less degree he is a heavy artillerist, a light artillerist, an infantryman to a sufficient extent to be available for that sort of duty in default of, or in conjunction with, regular land troops, and he is (or ought to be) a trained marksman with all kinds of arms found on board ship—trained to the limit of opportunity and personal possibility. He is expected to learn signals, though I personally think it an unwise waste of time to attempt to teach signaling, outside of the general and international codes at all events, to

every man of the seaman branch. Very possibly he may be called upon to act as a torpedoist and he may have to handle steam, hydraulic or electric machinery, in an humble capacity, perhaps, but not so humble that it will not be in the power of an ignorant or careless man to do immense damage. All this is in addition to the prime necessity that he be a sea-man. I hyphenate the word "sea-man" intentionally to differentiate it from the word "seaman" as commonly used, meaning simply a square-rig sailor. Our man-of-war sea-man should have the sea-habit, and a man-of-war sea-habit at that; he must be so familiar with man-of-war routine that he will naturally and promptly fall into place and be at home if transferred to a ship other than the one on board which he has been serving; he ought to be a good boatman, both under oars and under sail; he should know about ground tackle, be a good helmsman and leadsman, and be able to use palm and needle. These attainments are necessities for a sea-man. If, in addition, he can be made an expert top-man, able to set a studding-sail, send down a light yard, or pass a weather earing, so much the better; for such accomplishments are broadening.

The great limitation upon a system of training landsmen, and the only one worth considering here, is the short period of time that can be allowed for the work. In the first place the men are urgently needed to-day in general service and the demand is growing. In the second place the number of officers taken away from general service and the number of training ships needed vary almost directly as the length of the period given to sea training; but the service is relatively as short of officers as of men, and nobody is ignorant of our straits for training ships. Lastly there is the question of expense. All of these considerations point to as short a period of instruction and training as can possibly suffice for the proper, or even approximate, attainment of the object in view.

It must be evident that no system of training can possibly furnish to the general service finished man-of-war's-men; in other words recruits must be under training throughout enlistment. It remains, therefore, to consider carefully what can be done in the limited time given to training proper, including everything that *ought* to be done and as much more as possible. Opinions will naturally differ in this matter, and what is set

down below is the expression of my individual judgment of what it is indispensable to teach landsmen as thoroughly as possible before they are sent into general service:

1. How to keep their persons and clothing and bedding clean and in proper condition.

2. How to pull an oar in single and double banked boats, and the rudiments, at least, of boat sailing.

3. The use and care of arms, small and great.

4. Practice with small arms on shore ranges.

5. Practice with dotters, Morris-tubes and sub-caliber attachments as soon as promising men can be selected.

6. Drills of all sorts required in navy life.

7. Ordinary marlinspike seamanship, leaving advanced work for future opportunity.

8. Knowledge of the lead and line, and practice in getting soundings.

9. Knowledge of the compass. (This could be gained with a tithe of the present time and labor if the sensible compass with degrees only were adopted.)

10. Knowledge of steering gear and steering terms, and practical work at the wheel.

11. Knowledge of ground tackle.

12. Practice in going aloft and handling sail.

13. Some knowledge of signals, and a great deal for such as show themselves apt and *competent* to learn.

14. Work with palm and needle.

15. Practice for selected promising men with great guns at a time during the training cruise when the men can have been prepared to do good work and not waste ammunition.

Inspection of this outline of work will show how important a knowledge of arms and ability as a marksman are regarded. After all, these things are the *sine qua non* of a navy, whose business it is to be in the right place with its ships, the primary end of which is to carry arms and men to handle them; and, once there, to use those arms faster and more accurately than the enemy. This is not the place to discuss target practice, except incidentally; but a comparison of percentages of *actual* hits to shots fired, obtained abroad, with the best of our own percentages, obtained by guesswork methods, ought to remove

anything like complacency and set us hard at work. As far as the recruit is concerned, labor with him along this line ought to begin as soon as he is well on his feet in his new surroundings.

Very much of the work outlined above can be carried on at barracks, which are now doubtless permanent institutions. Some things can be much better taught there than on board ship, among them the principles of aiming and sighting, practice on the range, and infantry and artillery drills, including extended order. Both in barracks and on board ship instruction of landsmen in common school branches would best be left out of consideration, except possibly for volunteers in their leisure hours; landsmen are recruited at an age when young men do not take kindly to compulsory schooling. Best results will be obtained by making the training consist entirely of practical work. Lectures, except for entertainment, should be tabooed; nothing in the way of instruction bores men more quickly.

Valuable as is a preliminary course in barracks, however, it must never be lost to sight that the ultimate aim of training is to fit men for ship life; and for that recruits must spend a large part of the training period on board ship. There all the work laid down above as necessary can be carried on, though perhaps not as conveniently in some instances as in barracks. But on board ship the work is done under as close an approach to service conditions as the style of ship and the duty permit. Besides, and particularly, the recruit is introduced to his service home, a ship, and is taught to live in it with all the comfort possible. He learns what it is to live in closest contact with scores of other men, with a minimum of room for his effects, and how to do it with least friction; he passes through his own experience of sea-sickness and finds that it is neither permanent nor fatal; he gets used to the food provided in port and at sea; he discovers the thousand and one things that he may or may not do, that he must or must not do; his duties are performed while following a routine that shortly becomes second nature, and the like of which, in general features certainly, he will find throughout the service. In short, he is acquiring that vaguely defined yet perfectly understood thing—the sea-habit. The wrench involved in an absolute change in all the conditions of his life is passed with others as ignorant as himself, and he is

prepared at the end of the cruise to fall into place easily and promptly without an embarrassing feeling of utter greenness.

A great part of the sea-habit is acquired by merely living on board a man-of-war whether at sea or at anchor; but an indispensable part can only be acquired by actual cruising in blue water, and doubtless this consideration has prompted the requirement that half the time of a training cruise be spent at sea (or in such out-of-the-way places as Magdalena Bay). But I think it quite as important that at least half the period be spent at anchor. All the subjects enumerated as necessary in a preceding paragraph can be taught to recruits while at anchor excepting practice in actual steering, getting soundings under way, and target practice with great guns under way. On the other hand, some of them can only be carried on at anchor, such as boat drill, infantry and artillery drill in close and extended order, and all-important target practice with small-arms—the real thing where every shot is marked, not gallery practice which is only preliminary. The words "at anchor" are not intended to convey the meaning of anchorages in attractive ports where everything tends to distract men and officers from the work in hand—rather the reverse. Attractive ports may very properly be sought at times for the purpose of giving liberty; but the greater part of the time at anchor should preferably be spent at places where, with opportunities for reasonable recreation, as many conditions as possible are favorable for the work in hand and as few as possible available to distract attention.

In laying out the itinerary of a projected cruise many things ought to be considered. In the first place, of course, everything must bend to the object of the cruise—the instruction and training of the men—and this must be made to fit in with the limitations regarding the time to be spent at sea and at anchor, the ports to be visited for the purpose of giving liberty and obtaining supplies, the possibility of getting these supplies either by purchase or from home stations, mail and freight communications, healthfulness and general climatic conditions, weather and currents in connection with the itinerary and season of the year, and finally the possibility of following the itinerary closely.

Some of the stretches at sea should be long enough so that the recruit can get entirely over sea-sickness and be convinced from his own experience that life is worth living, even at sea.

Many a lad has deserted in a fit of disgust brought on by the misery of sea-sickness and new conditions combined who would have made an excellent man had he held on. If the first stretch at sea be short, and there are many good reasons why it should be, especially if the training ship has received her complement on the eve of sailing, the first anchorage should be in a place where the opportunities for desertion are the smallest possible.

The selection of ports for giving liberty is worthy of careful consideration. Recruits invariably look forward to an opportunity of seeing the strange sights of foreign places, and the gratification of this perfectly innocent and proper desire is a means of making them contented with the life, which they must become or else the whole scheme is a failure. Generally the same ports that are attractive for giving liberty are also good ones for obtaining supplies, but not always. During the present cruise of the ship on board which I am serving there was a period of about three months between Honolulu and Yokohama when not a potato nor an onion could be had. At Pago Pago, about a month out from Honolulu, fresh beef could be obtained as a great favor from the steamers twice every three weeks, and there was coal in plenty but no oil. At Guam, a month out from Pago Pago, poor sweet potatoes and tough carabao beef were to be had. Fortunately during our stay a transport came in and we feasted on cold-storage beef; but that was a happy accident. At Bonin Islands, on the way from Guam to Yokohama, we were more fortunate in obtaining fresh provisions, but neither nor coal nor oil were available had we needed them. At first blush it may seem almost trivial to mention potatoes and onions and dwell on fresh provisions, but it is not in the least so. Long enforced lack of these things will scarcely tend to make the recruit enamored of the life, especially as he knows from conversation with members of the regular crew that such privation is so unusual in general service as practically never to happen.

The necessity of considering healthfulness, climate, prevailing winds and currents and the season of the year is so self-evident that one hesitates to mention them; yet all the more because they are important they must not be forgotten or ignored. Almost equally important for the success of the cruise is the laying out of such an itinerary that it can be lived up to. At the beginning of a cruise the commanding officer plans his work,

some of which, as has been pointed out, can only be done at sea and some at anchor. A mutilated itinerary means a mutilated plan and the loss of a valuable part of the cruise somewhere.

The length of the cruise is a matter about which there is a wide divergence of opinion. At this writing I am making a ten months' training cruise, and I regard it as much too long. Six months at the most and four months at the least would be preferable. As has been urged above, men are needed badly, and those under training should be sent into general service as soon as practicable; perhaps at some later day this consideration will not press, but meantime the service is confronted by "a condition, not a theory." The length of the cruise must be considered in connection with the period spent in barracks, which ought to be not much, if any, less than three months; and the whole matter is complicated by the wide differences in the capacities of the several training ships as well as by the fact that recruits come as they can be obtained and not at any stated times. In any event the recruits should be retained in barracks long enough so that worthless and incorrigible ones can be weeded out and all have a fair preparation for man-of-war life. In from seven to ten months it would seem possible to turn reasonably well-trained men into general service.

With regard to the class of ship to be employed in training, the square-rigged auxiliary steamer of low power seems to me to be all around the best. In the first place, work aloft is valuable in all the directions claimed by the extreme advocates of sailing ships; again, auxiliaries are cheap to build and run in comparison with full-powered steamers; and finally, their steam power makes it possible to get into and out of port and to keep up with the itinerary, and provides naturally for condensing, electric lighting and steam flushing.

The position taken by advocates of the sailing ship pure and simple for training seems to me unjustified by conditions. When boys began on light sails, coming down to the lower yards as they grew in years and stature, and always serving on board ships with square sails, they became expert topmen; but it was not the work of one short six months' cruise. Quite the contrary, it was generally considered very fair work if that sort of education was thoroughly attained in a full cruise of three years. A training cruise lasts only a few months. Moreover the recruits

should be changed in station frequently enough to give all of them duty in different parts of the ship and under the immediate care of different division officers. Further there are not enough billets aloft to go around. Another consideration bears on this subject, at all events in the Pacific where distances are great, and that is the necessity of pushing on to the utmost to keep anywhere near the itinerary, so that time can not be spent for continuous daily exercises aloft. All of these things limit the time which an individual can be allowed to spend in a billet aloft, and the amount of work that he can do in that billet, and make it idle to expect that the result of such training will be expert topmen. The expert topman is unattainable except under prohibitive conditions, and it may as well be admitted frankly.

But, while making the admission, it yet remains true that training on board of a square-rigger under sail does make men active, strong and quick to respond, and cultivates intelligence, courage and resourcefulness. These are qualities of highest value; and, if they can be developed while other necessary parts of the training are in progress, there is every reason to seize the occasion. Such occasions arise in the sea trips, when sufficient time must be spent at sea to habituate the men to sea life, and for which there is no other reason to remain out. These trips may better be made under sail than under steam, if for the sole reason of the economy, and this matter of training is expensive at best. But besides, while no necessary feature of the training need be neglected, the recruits will be getting all the value of work aloft, and will doubtless have an added interest in feeling that the movements of the ship depend directly upon their individual work. Incidentally the experience and habits of watchfulness gained in keeping watch under sail are of very great value to the officers.

Now a yard is a yard whether it happens to swing over the main hold or the fire-room hatch, and it is difficult to see the point of view, under conditions of to-day, that inspires the insistence upon no motive power except sails. There would be much to say if the question at issue were the training of officers; but that is not the question. The possession of steam motive power by a training ship is in every way desirable. It will take the ship out of or into port in the face of adverse winds and currents, and one fails to discover what advantage in the training of

recruits accrues in tedious waits for favorable conditions. Steam will take the ship across the doldrums in a few hours where as many days might be spent under sail alone. It will generally enable the itinerary to be followed closely, and that is important. It provides naturally for condensing, and even in true sailing ships that is provided for now-a-days; the time is past when it was thought necessary or wise to deprive men or officers in the matter of fresh water. Steam provides for the installation of electric lights, which are practically necessities in this day and generation. It is a pitiful sight on board this ship, the Mohican, to see the landsmen crowded about the standing lights trying to read or write in their leisure hours, and straining their eyes in the attempt. Nobody expects to illuminate training ships "with electric lights like an excursion steamboat, or an army transport in the presence of the enemy," as it was put by one officer in the discussion of Captain Chadwick's letter in these pages; but on every ground of convenience, health, discipline and morality that has prevailed to secure the installation of electric lights on board all cruising ships it is desirable to do the same for training ships. Steam flushing is not a necessity but it is a comfort, and when the circulating water for condensing is made to do the work it is a matter of trivial expense.

There is one characteristic that should always be found in a training ship—she should have open decks. The men are on probation and should always be under observation, which is not possible in a ship full of compartments. The auxiliary steamer is at a disadvantage in this respect compared with a sailing ship, but not to a serious extent.

Taken all around, then, the square-rigged auxiliary steamer of low power seems the best style of ship with which to conduct training cruises. Such a ship should be able to carry stores and provisions for three months *for her full complement as a training ship*, and coal enough to steam 1000 miles and provide for auxiliary needs for thirty to forty days besides. Considering the kind of service, a very considerable part of the space allowed for ammunition could be spared and still leave an ample supply for target practice and the possibility of being caught away from home waters upon the breaking out of war. Ships of special design would be best, but a number of our old ones in use approach more or less closely to the requirements of the duty,

though much room is wasted owing to the antiquated design of engines and boilers. It ought not to be a difficult matter to design such ships as are needed, having light and compact engines and a hoisting propeller. They would steam well enough for every purpose required by their duty, and would sail well with the propeller up.

Training ships should be as liberally officered as the Department finds it possible, and the complement of officers should be adjusted to the number of men under training as well as to the class of ship. It is absurd to expect as good results from one ship with a complement of 350 men under training as from another with 200 if both have the same number of line officers, or even if the respective complements of line officers do not vary somewhat closely as the complements of men. An instance is known where a ship started on a training cruise with 260 landsmen and three watch officers, and no junior or warrant officers; moreover, the complement of petty officers of the seaman branch was little more than half full. It was a very discouraging experience.

There is a limit to the number of men that one officer can hold the interest of, on the one hand, or keep properly under his eye, on the other. On board training ships I would put that number at about thirty-five. It is not necessary to have as many divisions as there are multiples of thirty-five, but there should be that many line officers for division duty. Each division should be commanded by a commissioned officer, and he should be assisted by a junior if it contains more than thirty-five men, or forty at most. Midshipmen would be of greatest assistance on board the larger training ships, and they would be getting excellent experience as well; perhaps no better duty for their own good could be given them the first year after being graduated from the Academy. But intelligent line warrant officers of the excellent stamp now coming into the service would fill the want if midshipmen are not available. The complement of line officers is not a question of tonnage simply, nor of a fixed number of watch officers, but rather of the service required; and of no class of ships is this truer than of training ships, whose complements approach, and I believe exceed in some instances, those of large cruisers and even battleships. In this connection it is interesting to compare in the Register of January, 1902, the lists of

officers of training ships with those of general service ships carrying somewhere near the same number of men.

The permanent crews of training ships should be carefully selected men and *all ratings should be kept filled,* even at the expense of the service at large; and this is not said in ignorance of conditions. My experience with one such crew is that it was not selected at all—just happened—and has never once been filled up since the ship went into commission. Men have been drafted into it for the sole reason that they held the vacant ratings—men in some instances who found themselves on board the receiving ship for the very reason that they had been considered undesirable on board training or other ships. At this very writing,* of 44 allowed ratings in the seaman branch of petty officers 18 are vacant, a percentage of 41. It is to be hoped that the case is exceptional. The general service can surely better spare a petty officer here and there from complements already trained to a great degree than permit training ships to suffer from the tremendous disadvantage of such a list of vacancies.

From the men under training, including always the apprentices, must come our petty officers of the future, and it is worth while for this reason alone to send to training ships the full number of petty officers required, men of such professional and personal character as to inspire respect on both counts, even, I repeat, if the general service be inconvenienced temporarily.

The equipment of training ships should be liberal and up-to-date in all matters affecting the training. It seems almost wasted time to work with Lee straight-pull rifles on board a training ship when the Krag-Jörgensen has been the service arm for many months. Perhaps it is early yet to insist on dotters and Morris-tubes, which are in the trial stage in our service though long past it in another; but, believing in them, I believe that they should be at every training barracks and on board every training ship. Professional drill-books, hand-books and text-books should be liberally supplied, and under such regulations that they can be freely consulted; there is always a demand for such books, and it is difficult, and often impossible, to meet it.

* June, 1902.

To recapitulate, the following are the salient points of a system of training landsmen as the subject appeals to me:

(a) Utmost care in selecting recruits and utmost candor in explaining conditions to be met in the service.

(b) A period of training in barracks to last not less than three months, during which the men can be thoroughly shaken down, gotten into complete uniform, taught much about the care of their persons and clothing, drilled constantly, and be so effectually under observation that unworthy ones can be weeded out.

(c) A cruise of from four to six months during which the training and observation continue.

(d) Of this cruise half to be spent at sea and half at anchor. Of the part at sea, one stretch should be not less than twenty days in duration, and better thirty, so that the men can get thoroughly over sea-sickness and grow accustomed to sea life.

(e) The aim of the training to make man-of-war's-men of to-day, disciplined men of courage, who can attend to all the duties required in modern ships and take their places at once and with ease, wherever assigned.

(f) The feature to be insisted upon all through is the education of men to be familiar with the care and use of arms of all descriptions found on board ship; and, above all, to train each man to the limit of his ability to shoot straight and fast.

(g) Itineraries intelligently made out to secure every possible advantage of healthfulness, good weather, favorable winds and currents for making passages, attractive ports for giving liberty and convenient ports for obtaining supplies, and anchorages providing good working ground for boating, target practice, drills on shore, and, if possible, sea room for daily drill with the ship under way under sail.

(h) Training ships of the square-rigged auxiliary class.

(i) A sufficient number of line officers on board each ship to do the work required in a proper manner.

(k) Carefully selected and full permanent crews for training ships.

(l) Liberal equipment in all matters affecting training.

The foregoing pages have been written entirely from the standpoint of the training of landsmen, not the training of apprentices. The two matters are closely allied and yet not at all

identical, and they should not be confounded either in thought or practice. The necessity that has existed on the Pacific coast of having apprentices and landsmen at the same station, to be trained by the same staff, has not worked to the advantage of either, as I am sure the members of that staff will be the first to acknowledge.

If I understand aright the underlying reason for training landsmen it was, and is, to man our ships (that are coming on faster than the trained personnel could expand under old conditions) with a force already somewhat trained and not utterly green. The apprentice system could not provide the increasing numbers demanded, and it was a question of manning each ship with a very large proportion of raw recruits, or else giving the recruits preliminary training under circumstances calculated to do the greatest good to the greatest number. I do not believe in sending recruits in any considerable numbers directly to general service ships; for it is difficult to see how their training could be as consistent or thorough in the same time under those circumstances as if it were given on board training ships. Moreover, the crews of general service ships should be as homogeneous as possible, which is far enough from being the case at best; but the presence of a large proportion of raw recruits would do more to retard the general efficiency of a particular ship than the adoption of that method of training would do for the advancement of the recruits on board. Broadly considered, every naval vessel is a training ship at all times; but those in general service should not be handicapped with a primary department if it is possible to avoid it.

It might be a wise thing to place the whole subject of the training of the enlisted personnel in the hands of a board of officers for study and recommendation. Such a board would consider the subject from the enlistment of recruits, apprentices or landsmen, until they were drafted into cruising ships at the end of their training cruise. It would know the aims of the Department, on the one hand, and could have the opinions of many officers of experience, on the other, and the result of its deliberations could hardly fail to be of great value, if only because of the amount of information that would be made available in an orderly and digested form. At the best, its report would be a basis for systematizing the whole matter, establish-

ing a policy and defining such regulations to govern training as would insure consistency, thoroughness, and, in general, best results.

As a final word, I record my entire agreement with the general tenor of Lieutenant Beach's remarks in No. 101 of the PROCEEDINGS regarding the establishment of an Office of Naval Training. It would come naturally under the control of the Bureau of Navigation, and its head should be an officer of acknowledged ability and experience, and of high enough rank to carry weight with commanding officers of all training stations and ships. Its functions should be entirely distinct from those of any office now existing to my knowledge, and should include the administration, under the Chief of Bureau of Navigation, of all matters pertaining to the training of the enlisted personnel before men are drafted into general service, and possibly even after that time. Under the intelligent direction of such an office the entire work would be systematized, that of units co-ordinated, anomalies and inconsistencies would be done away with, and the training of the enlisted personnel become in name and fact a system.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE QUESTION OF NAVAL ENGINEERS.

By LIEUT.-COMMANDER HARRY P. HUSE, U. S. Navy.

A majority of the officers of the navy believe that the amalgamation of the line and the engineer corps in 1898 was the best solution of the difficulties laid before the board presided over by President Roosevelt, then Assistant Secretary of the Navy. At the same time, it is probable that few officers are of the opinion that the present outlook is satisfactory and that matters should be left as they are.

THE PRESENT SITUATION.

We now have a sufficient number of experienced engineers of high technical education to design the machinery for our ships at the Bureau of Steam Engineering, superintend their construction at the shops, and care for the departments in our great battleships and armored cruisers. But these are members of the old engineer corps who have little military training and who, having reached an age when they could not be expected to take up military duties, were incorporated in the line, but with restricted functions. They are to perform engineering duties only; and, after reaching the rank of commander, cannot be sent to sea.

The new conditions have produced an excellent course in mechanical engineering at the Naval Academy, and every graduate is competent to quickly learn the duties of a line officer in the engine-room as well as on deck. Regulations properly prescribe rotation of duties on deck and below. More time should be required below; but the lack of officers has lately made it impossible to carry out this intent of the personnel bill.

private firms is of even higher order, and would naturally fall to officers of the same or of higher rank. The lowest grade, then, in which special training as engineers will be required is that of lieutenant-commander; below that grade the ordinary training of the service is sufficient to produce the skill and professional engineering qualifications required. The problem is narrowed down to how we shall obtain these officers without creating an engineer corps with all its disadvantages.

Again the solution is found in the accidental position of the officers of the old engineer corps who have not qualified for line duty.

A Proposed Solution of the Problem.

Every officer below the grade of lieutenant-commander is required by the regulations to perform duty in the engineer department. No change in the present system is necessary here except that no young officer should ever be detailed for *instruction* below; all details should be for *duty* and should involve responsibility.

On the completion of a cruise as a full lieutenant, any officer should have the privilege of applying to take the course at the engineering school soon to be established at Annapolis. On passing into the grade of lieutenant-commander, officers having successfully finished this course should have the option of declining the military examination for promotion and taking instead the engineering examination. From that time on they would be in exactly the position of the officers of the old engineer corps who have not qualified for line duties, except as provided below in the case of fleet engineers. As it is somewhat difficult to see why, on shore, such officers should not perform any kind of duty except that of a strictly military character, the number of billets open to them might well be enlarged.

These officers would have to do considerable hard study, and some inducement would doubtless have to be offered. This might better take the form of giving extra pay to them in the grade of lieutenant-commander and the old pay of fleet-engineer to commanders acting as such.

It would probably be unnecessary to change the navy-list as it exists at present. It is to be remarked that the officers qualifying for engineering duties are not to constitute a separate

corps, but are to form part of the line of the navy on exactly the same footing as the officers of the old engineer corps who have not qualified for line duties.

As it is only necessary, so far as duties at sea are concerned, to provide these specially trained engineers for the battleships and armored cruisers, there would be sufficient for this purpose if one-third of the lieutenant-commanders, or between fifty and sixty, were thus qualified. This would mean that on an average every third officer coming up for examination for promotion to the grade of lieutenant-commander would elect to take the engineering examination. The remaining two-thirds would be sufficient to furnish commanders for the gunboats and executives for the large ships.

Promotion of Warrant Machinists.

Although nothing could be more democratic than the way of appointing midshipmen to the Naval Academy, still the spirit of the age seems to require that an enlisted man in the service shall be able, if specially fitted, to get a commission. The writer is of opinion that only good results will be obtained from the promotion of a limited number of carefully selected warrant officers. Accordingly, while strongly opposed to commissioning the present warrant machinists and thus creating a new engineer corps with all the bad and none of the good features of the old system, it seems to him desirable that warrant machinists of marked ability, under carefully considered conditions and after passing an examination, should be allowed to take the proposed course of engineering at Annapolis, and should then be given the opportunity to qualify as lieutenant-commanders for engineering duties. One necessary qualification should be at least ten years' experience afloat as a warrant machinist in the navy. The number should be limited to three or four a year, and, as the whole object is to provide highly skilled naval engineers and not merely accomplished machinists, the examinations would necessarily be severe, and the successful candidate would be entitled to all he would get.

Fleet Engineers.

There is great need of a fleet engineer in every squadron who shall at all times be able to inform the squadron commander

of the condition and needs of the engineer departments of the ships under his command, recommend repairs, and in fact be the consulting engineer of the squadron. He should have no more to do with the engineer department of the flagship than with that of any other vessel of the squadron. The position would be one of much responsibility and dignity and should be filled by a commander or a captain who might better be a member of the personal staff.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A METHOD OF IDENTIFYING AN OBSERVED STAR OR PLANET.

Suggested by LIEUTENANT G. W. LOGAN, U. S. Navy.

When a star or planet is observed at sea for obtaining the position of a ship, means of identification are generally furnished by its own characteristics of magnitude and color and by the relative location of other bodies—a star chart being employed to assist the observer if he is not familiar with the heavens. Cloudy weather, moonlight, or daylight may, however, prevent identification by this means.

If in doubt as to the name of the body at the time of taking the sight, it should be made an invariable rule to observe its bearing by compass, whence the true azimuth may be approximately deduced by applying the compass error. If the observer plots the position of his zenith on a star chart, using the local sidereal time for right ascension and the latitude for declination, the co-altitude (zenith distance) and azimuth may be laid off approximately and, with a knowledge of the star's magnitude, lead to the identification; or an estimate may be made of hour angle and declination, (the hour angle applied to local sidereal time giving the right ascension), and the star or planet thus recognized from an inspection of the tabulated values in the Nautical Almanac. These rough methods generally suffice where the body is the only one of its magnitude within an extensive region of the heavens; but cases often arise where a much closer approximation is necessary. The method to be described may then be employed.

The quantities given are the corrected altitude and azimuth,

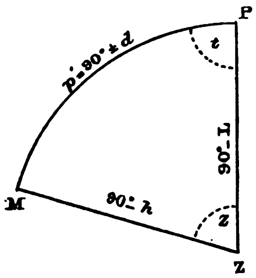
and the dead reckoning latitude; those to be found are the declination and hour angle.

In the astronomical triangle, *PMZ*, shown in the figure, let Z = azimuth, t = hour angle, p = polar distance, d = declination and h = altitude. Then,

$$\frac{\sin Z}{\sin p} = \frac{\sin t}{\cos h}; \text{ or, } \sin Z \cos h = \sin t \cos d.$$

The value of $\sin Z \cos h$ (calculated from the given azimuth and altitude) must therefore equal $\sin t \cos d$, whatever the values of t and d may prove to be.

From a given latitude, azimuth and declination, the hour angle may be found either by azimuth tables of an azimuth diagram; or from a given latitude, azimuth and hour angle, the declination may be found by the same means. If, therefore, some probable value of the declination be assumed, using the known latitude and azimuth, we may ascertain the corresponding hour angle; or if the hour angle be assumed the corresponding declination is obtained; then the product of $\sin t \cos d$ may be calculated, and if it agrees substantially with $\sin Z \cos h$, the trial values of the hour angle and declination are the correct ones; if not, other trials may be made until the correct ones are found. It may be remembered that absolutely exact results are not sought.



In practice, the operation may be made very short; the values of the quantities may be taken in even degrees and the logarithms need not be carried beyond the third place; the sum of the logarithms will suffice and the corresponding numbers do not have to be taken out. The possibility that the observed body may have been a planet must always be kept in mind in looking it up in the star table or chart.

As an example, suppose that in latitude 5° N., longitude 2h. 50m .W., by D. R., a star is observed whose corrected altitude is 38°, and true azimuth N. 107° E. The Greenwich sidereal time (as computed for use in the regular working of the sight) is 12h. 53m. Let it be required to identify the body.

First find the logarithm of $\sin Z \cos h$.

$$\begin{array}{rr} Z, & 107°, \sin 9.981 \\ h, & 38°, \cos 9.897 \\ \hline \sin Z \cos h, & \log 9.878 \end{array}$$

Now suppose the observer estimates from the position of the body that its declination is 3° S. Look in the azimuth table on the page of latitude 5° (declination contrary name to latitude) and note the hour angle (P. M.) corresponding to Dec. 3° and Az. 107°; this is found to be about 1h. 40m. With $d = 3°$, $t =$ 1h. 40m., find $\sin t \cos d$. (Sin t may be found either by converting time into arc and taking from the table in the usual way, or by multiplying by 2 and finding it from the column headed "Hour P. M." Thus in the present case, find the sine of 25° 00′ or of 3h. 20m. In using the time column, be careful to take the name from the foot of the page when the double angle exceeds 6h.)

$$\begin{array}{rr} t, & \text{1h. 40m.}, \sin 9.626 \\ d, & 3°, \cos 9.999 \\ \hline & \log 9.625 \end{array}$$

As this logarithm should equal 9.878, it is seen that the assumption is incorrect. Try a value of the declination 5° farther south, that is, 8° S. The corresponding hour angle is 2h. 50m.

$$\begin{array}{rr} t, & \text{2h. 50m.}, \sin 9.830 \\ d, & 8°, \cos 9.996 \\ \hline & \log 9.826 \end{array}$$

The logarithm is not yet quite large enough; assume declination 10° S.; the hour angle is therefore 3h. 20m.

$$\begin{array}{rr} t, & \text{3h. 20m.}, \sin 9.884 \\ d, & 10°, \cos 9.993 \\ \hline & \log 9.877 \end{array}$$

This is practically identical with the logarithm of $\sin Z \cos h$, and the correct values are, therefore, $t =$ 3h. 20m., $d = 10°$ S.

We have:

G. S. T.	12h.	53m.
Long.	2	50 W.
L. S. T.	10	03
H. A.	3	20 E.
R. A.	13	23

By star chart or table, it is found that the right ascension of Spica is 13h. 20m. and the declination 10° 39′ S.; this is therefore the body observed.

Taking another example, suppose that on January 1, 1902, in latitude 26° S., longitude 5h. 42m. E., by D. R., the altitude of a body is observed as 41°, and its azimuth as S. 84° W., the Greenwich sidereal time being 17h. 59m.; to find the name of the body.

Z, 84°, sin 9.998
h, 41°, cos 9.878

sin Z cos h, log 9.876

Assume first an hour angle of 3h. 00m.; the corresponding declination is 23° (same name as latitude).

t, 3h. 00m., sin 9.849
d, 23°, cos 9.964

log 9.813

Next assume an hour angle of 3h. 30m.; the declination is then 21° S.

t, 3h. 30m., sin 9.899
d, 21°, cos 9.970

log 9.869

Assume hour angle 3h. 35m.; declination is still nearest to 21° S.

t, 3h. 35m., sin 9.907
d, 21°, cos 9.970

log 9.877

The last assumption is therefore correct.
We then have:

G. S. T.	17h.	59m.
Long.	5	42 E.
L. S. T.	23	41
H. A.	3	35 W.
R. A.	20	06

As there is no fixed star corresponding to these coordinates the tables for the planets should be consulted. On January 1, 1902, the right ascension of Mars is 20h. 08m., and the declination, 21° 20′ S.; this is therefore the body that was observed.

It is to be remarked that the exactness with which the comparison of logarithms is carried out will depend upon the possibility of errors of identification in the region of the heavens involved. It will not usually be necessary to find the correspondence as closely as has been done in the examples given, and the cases will be rare when, with a fair estimate of hour angle or declination at beginning, a sufficiently accurate knowledge of the values can not be arrived at after the second approximation; and frequently the first will suffice for identification.

Azimuth tables intended for the sun are not available for use with bodies of greater declination than 23°. Azimuth diagrams give all values of the declination; the U. S. Hydrographic Office has in press azimuth tables which include declinations up to 70°.

The following is a summary of the method employed:

1. Reduce time of observation to Greenwich sidereal time and find the true altitude to the nearest degree. (These operations must be performed before any sight can be worked; they are, therefore, not strictly a part of the process of identification.)
2. Correct the observed azimuth for deviation and variation.
3. Find the logarithm of sin Z cos h to the third place.
4. Assume a declination and find the corresponding hour angle that will produce the given azimuth at the given latitude; or assume an hour angle and find the corresponding declination. Use an azimuth table or diagram for the purpose.
5. Find the logarithm of sin t cos d to the third place.
6. Observe whether this agrees with the logarithm of sin Z cos h, and if it does not, repeat trials until an agreement is found.

7. Having found the hour angle and declination, convert the Greenwich sidereal time into local sidereal time and subtract the hour angle if west, or add it if east; the result is the right ascension of the observed body, by which, with the declination and magnitude, the identification is accomplished.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

ANOTHER GRAPHIC SOLUTION IN COAST NAVIGATION.

By Captain Charles D. Sigsbee, U. S. Navy.

In the Proceedings of the U. S. Naval Institute, No. 3, of September, 1902, an ingenious graphic method for finding progressive bearings, distances, and land marks, in coast navigation is described. The method requires (1) instrumental adjuncts not in daily use by the navigator, namely, cross section paper and protractor, and (2) the transference of positions from the cross section paper to the hydrographic chart.

Since 1874 I have used a simpler and equivalent method, which requires only the plotting instruments in common use by the navigator, namely, chart, parallel rule, pencil, and dividers. I originated the method, for my own use at least, while engaged in deep sea explorations with the U. S. C. S. Steamer Blake, the process is so simple that it would not surprise me to find that it is old. Nevertheless, in showing the method to others, I found but one naval officer who had previous knowledge of it. That officer learned it in the Coast Survey, and subsequently to 1874.

In 1895, while I was in charge of the Hydrographic Office, Navy Department, I caused the method to be published in certain volumes of sailing directions for the great lakes. For example, it is given on page 84 of "Sailing Directions for Lake Huron, Straits of Mackinac, St. Clair and Detroit Rivers, and Lake St. Clair. No. 108—Part III. 1895." The following explanation of the method is quoted bodily from that work:

In Fig. 2, a vessel proceeds in a direction *A* to *B* without changing her course. At both *A* and *B* she takes a compass

bearing of the landmark *L*, and at *B* notes the distance run on her course from *A* to *B*. A parallel ruler is set to the course *AB* by means of the compass rose on the chart, and the distance run from *A* to *B* is taken from the scale of the chart with a pair of dividers. The parallel rule is then moved to and fro as shown by the dotted lines, and the dividers are applied to its edge until the parallel line *AB* is found, on which the intercepted distance *AB* is exactly spanned by the dividers as set by the scale. The line *AB* then represents upon the chart the course of the vessel. *A* is the point where she took her first bearing, and *B* the point where she took her second bearing.

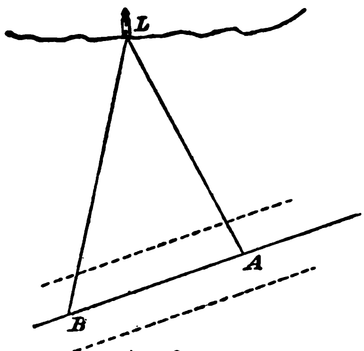


Fig. 2.

Questions of current apply to the above solution in the same manner that they deply to the solution, cited in the first paragraph of this paper, and to the well known solution by means of bow and beam bearings.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE TACTICS OF THE GUN.*

By Lieutenant-Commander A. P. Niblack, U. S. N.

The battleship is the epitome of sea power. Reduced to its simplest terms it is a floating gun-platform. As a unit of offense it contains, on a given displacement, the maximum of concentrated destructive power, (*a*) for battle on the high seas for which it is primarily designed, and (*b*) for coast attack, which is its secondary and seldom-used purpose.

The difference between the tactical values of battleships and of cruisers, torpedo-boats, submarines, and rams, are those of degree rather than of kind, for each merely chooses some weapon or some quality of the battleship, and sacrifices everything else to it. The special tactics suited to each are dictated by the battleships. Cruisers, torpedo-boats, and rams must have speed to avoid encountering them unwillingly or to deliver their blow in the shortest time so as to escape as much gun-fire as possible. Submarines must be invisible. Nothing is here said of monitors, for their function is purely harbor defense, and as gun-platforms in a seaway they are wretched owing to rapid oscillation. On the other hand, in the design of the battleship, we must secure immunity from the other classes of vessels, but this is done, as far as equipment, construction, and ordnance are concerned, by quick manœuvring qualities, powerful secondary batteries, search-lights, nets, and other auxiliary appliances, but, primarily, battleships are meant to fight battleships on the high seas, and it is in this view of gun against gun that we shall consider the question of tactics.

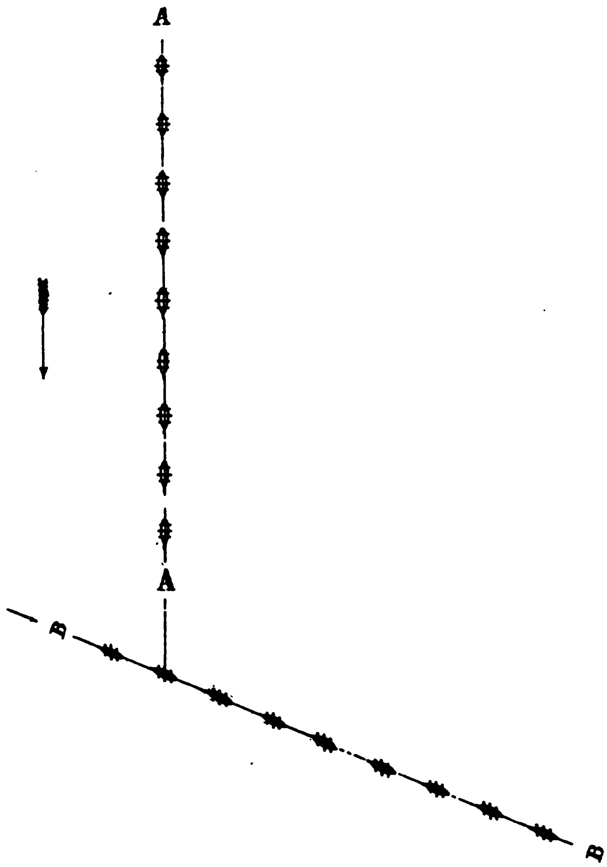
It is the function of the ram and of the torpedo to penetrate the under-water body of a ship, and breaking down its water-tight subdivisions, or striking it in a vital point such as a magazine or boiler, to destroy it. It is the function of the gun to put out of action the battery and *personnel*, but as long as a ship retains her motive power, steering gear, and her personnel other than that at the battery, the gun is almost powerless to destroy. To be more explicit, it is only by luck or by indirection that a modern battleship can sink another by gun-fire alone. We need not in the future expect to set ships on fire by gun-fire, as at Santiago or Manila, and, indeed, we have a long way to go before we can

* Read at the 10th General Meeting of the Society of Naval Architects, New York, November 20, 1902.

expect to achieve victories over our next adversary. This is a warning and not a prophecy.

The individual gun is the unit of offense, in one sense, but the combined fire of as many guns as possible, directed according to a definite scheme, by means of well organized fire control, alone means victory.

Fig. 1.



The key to modern fleet actions is concentration of gun-fire. To achieve this we must instal our guns properly, and we must of all things train our personnel. Fleet formations should be based on gun-fire, and in battle we should limit tactical movements to those which least disturb it.

The object of all tactical manœuvres or movements of a fleet previous to or in a fleet engagement should be:

1st. To get and keep the enemy within a close effective range.

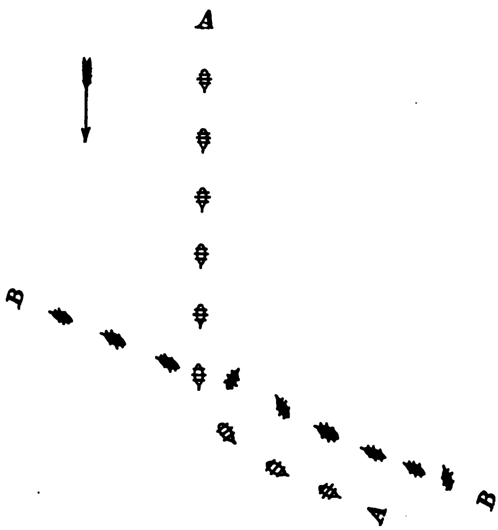
2d. To endeavor to get a superior position in order to mask some of his fire, or increase the effect of your own.

3d. To hold an advantage gained or losing it to manœuvre for a fresh one.

4th. To avoid waste of ammunition.

5th. To get out of a position of disadvantage or one in which a move of the enemy may threaten to place you.

Fig. 2.



6th. To concentrate gun-fire on certain ships of the enemy in order to reduce the tactical efficiency of all his ships by crippling one or more.

7th. But of all things to deliver a rapid crushing fire at the earliest possible moment, thereby injuring at once his initiative and increasing your own offensive power in a geometrical ratio as you destroy his.

Modern steam fleet-tactics differ in many essentials from the tactics of the sailing-ship period and from military tactics on shore. In the days of sailing ships practically all guns were necessarily mounted in broadside, and bow and stern fire, for structural reasons, were inconsiderable. The natural formation was column (or "line ahead," as it is called abroad), as this gave the greatest effective fire, viz., broadside. In the approach of such fleets to each other in an engagement very few guns could be brought to bear, and the preliminary manœuvring was generally to secure the weather-gauge, or windward position, which gave the advantage of forcing the engagement, or withdrawing from it. The

supreme tactical advantage was gained by "breaking the enemy's line" (column of vessels), throwing his formation into confusion, raking his nearest ships in passing through, and escaping most of his broadsides while delivering your own successively and in its most effective form. Thus, in Fig. 1, the "A" fleet, having the windward position, bears down in column (line ahead) before the wind and breaks through B's

Fig. 4.

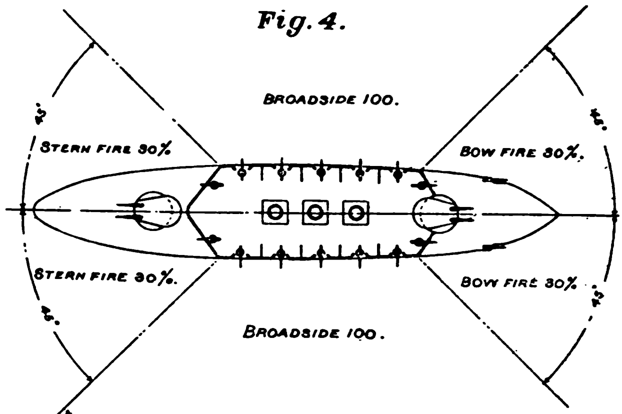
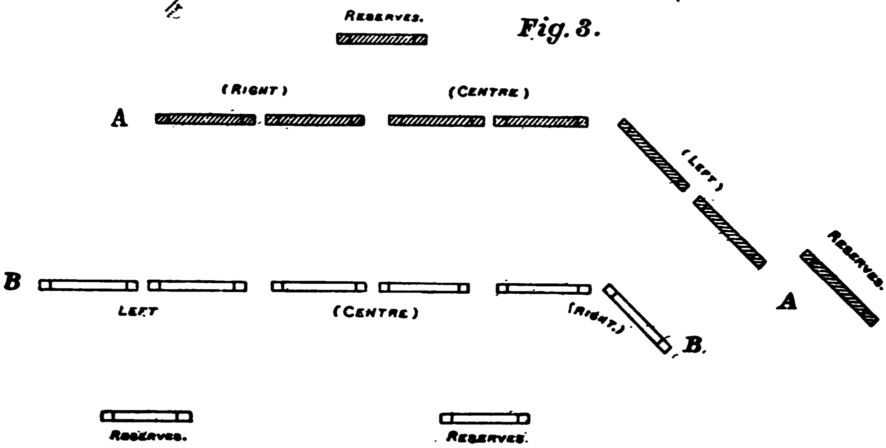


Fig. 3.



column (or "close hauled line ahead"). In the approach, Fig. 1, A's leading ship or ships get the broadside of several of B's without being able to reply with more than a few bow guns, but the danger zone being small, and, once having an opening, the A fleet, Fig. 2, goes through, raking B's nearest ships, and doubling down the wing on his disorganized and confused formation.

In an army on shore, on the other hand, line formation ("line abreast," as nautically expressed abroad,) must necessarily be the offensive formation, since men must shoot to the front, and hence "bow fire," so to

speak, is the only fire. Troops advance on each other, delivering their maximum fire as they approach, and the tactical advantage is gained by turning the enemy's flank, and thus avoiding or "masking" the fire of his center and of his other flank (Fig. 3). Military tactics are thus practically the reverse of those of the sailing ship period.

With modern battleships, the installation of pairs of heavy guns in the ends of ships, and the introduction of the ram and the torpedo have changed naval tactics. Bow and stern fire is now a little less than 30 per cent of each broadside fire, instead of about 5 per cent as in the sailing ship days, and to attempt to break through an enemy's column, as in Figs. 1 and 2, would be the height of folly. The leading ships of A, with less than 30 per cent of their total fire available, would, in attempting to break through, be withered by the powerful concentrated broadsides of B's column, or destroyed by his torpedoes, or sunk by his rams. Then, too, raking fire has lost its terrors because the bow and stern presentation of a modern battleship is very strong owing to its concentration of heavy armor in the casemates, barbettes, and turrets. In other words, at close quarters, a raking fire is not necessarily any more disastrous than firing at the broadside.

We thus have in modern steam-fleet tactics a sort of half way, or a compromise, on sailing ships and military tactics, for "to turn the enemy's flank," as in the army, is a good manœuvre; the approach to the attack in line is now feasible, as it gives about 30 per cent of gun-fire; and column, as in the past, is the formation giving maximum effective gun-fire. As stated before, the function of the gun is to destroy the battery and personnel, because armor and the water-tight subdivisions make it well nigh impossible to reach the vitals of a ship with gun-fire alone, except with plunging fire at long range, and destruction is the function of the ram and the torpedo. (Incidentally, as will be shown later, it is the large port openings and failure to isolate gun positions in most of our battleships that constitute sources of peril with an enemy that can shoot.) To state the general proposition more in detail, with steam and modern improvements—

1st. Bow fire has become a great factor in modifying tactics.

2d. The ram is more than ever a dangerous and fatal weapon.

3d. Armor has almost nullified the great danger from raking fire at close quarters.

4th. The torpedo has made it dangerous to fight at closer range than 1000 yards.

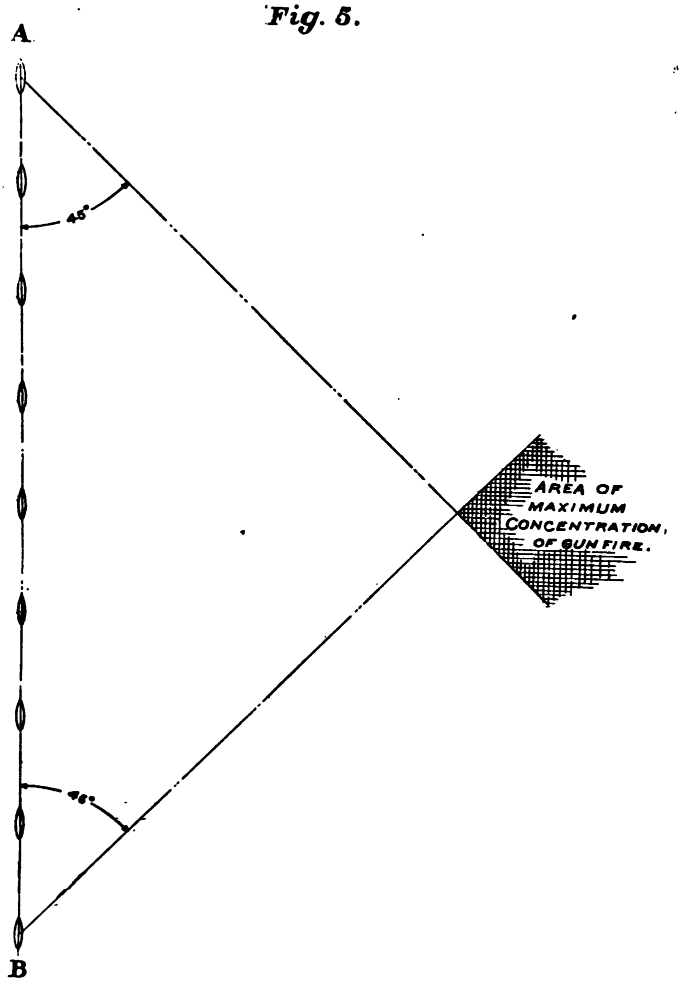
5th. Smokeless powder and high speed make the windward position of little importance compared with getting the sunlight on the enemy and in his eyes.

6th. Elaborate subdivisions in ships tend to prolong the time and increase the difficulties of the destruction of a ship by any weapon.

To illustrate the relation between formations and the concentration of gun-fire, a series of diagrams are herewith appended. In the unit battleship, as in Fig. 4, it is considered that a ship can bring her whole broadside to bear 45 degrees forward or abaft the beam, and, for convenience, we will consider only one broadside at a time. The bow and stern fire is 30 per cent of the broadside. With a number of ships in column, as in Fig. 5, the area of maximum concentrated gun-fire is

abreast the middle ship and at a distance equal to half the length of the column. The nearest that ships can steam in column, and do anything else, 200 yards' interval, or "half distance," as we call it, and it is important to note that, in this case, with nine ships, the distance of the area

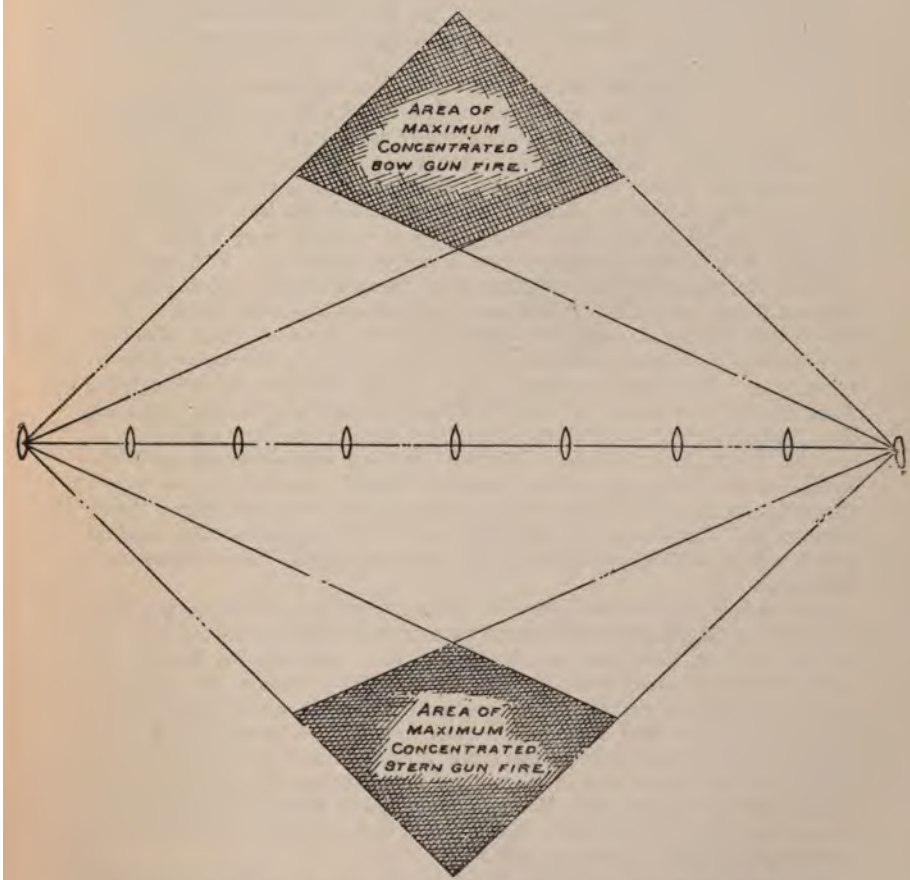
Fig. 5.



of maximum concentrated gun-fire is 800 yards, which is quite easily within torpedo range to-day. I am personally mentally incapable of understanding the reasoning which has led the Board on Construction, in the Navy Department, to leave underwater discharge torpedo tubes out of the recently designed battleships and armored cruisers. (We have them only in the Maine, Missouri, and Ohio, of all our ships in the

Navy). Every one regards above-water torpedo tubes, in such ships, even behind armor, as rather dangerous, but with, as I believe, the very best and safest under-water discharge system, and with either the new modified Obry or the Kaselowsky attachment fitted to torpedoes, it is inconceivable that any one can argue against under-water tubes for

Fig. 6.



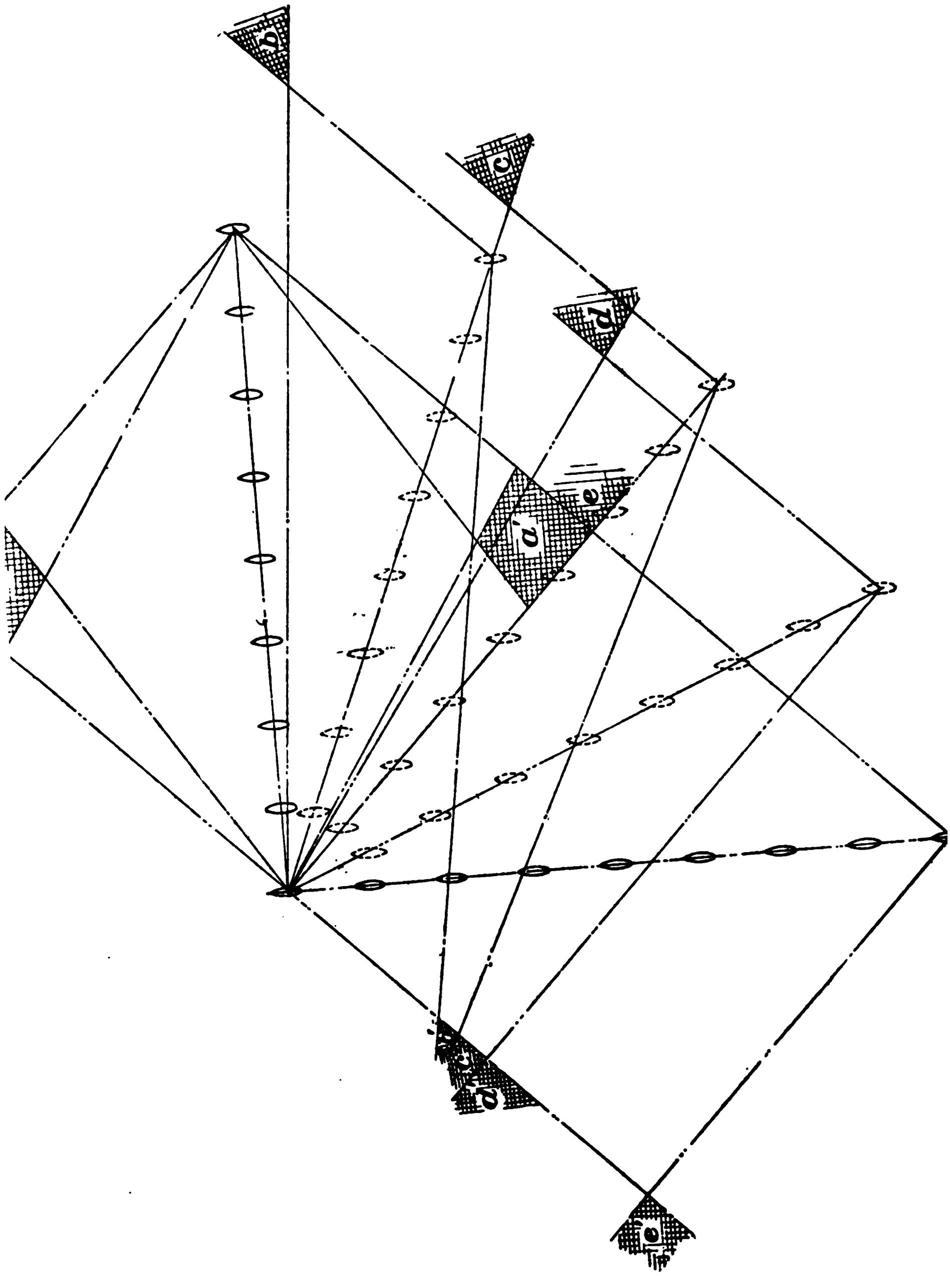
modern battleships. In fact, a ship is not a battleship unless she has them. I have personally seen under-water discharge abroad with our type of tube, and the modified Obry gear, with 1000 yards run, in this country, and I have as much faith in the accuracy and reliability of the torpedo as I have in the twelve-inch gun. Modern fleet tactics demands the torpedo. Its mere presence on board limits the range at which gun-

fire may be used in single-ship actions or in fleet engagements, and just when the torpedo is beginning its development it seems to be a poor time to dispense with it. A battleship disabled in her battery, but intact below the waterline, is an ugly problem if her ram and torpedoes are also intact. She is still capable of sinking one or more battleships if desperately and skilfully handled. I repeat, it is a grave mistake to leave these tubes out of our ships, and I earnestly hope the Secretary of the Navy will intervene and save us from the results of this short-sighted policy. Twelve feet between bulkheads will give us ample space to operate a tube on each side, and as we may soon see torpedoes with 1500 yards range, it behooves us to retrieve, as far as we can, our mistake in this particular.

In Fig. 6 we see that the area of maximum concentrated gun-fire of a fleet in line is near the center ship. The two flank ships are firing the forward broadside guns just clear of their next in line, and all others are using bow fire only. In Fig. 7 the various formations are on lines of bearing two points (22½°) apart. The fleet is first supposed to be in line, as in Fig. 6, and by pivoting on F to change the line of bearing to the right two points at a time until column is reached, as in Fig. 5. This diagram is for both batteries, and is very suggestive. For instance, with the starboard battery, a change of two points from line to the second position throws the area of maximum concentrated gun-fire from *a* to *b*; two points more to *c*; two points more to *d*, and in column to *e*. Whereas with port battery the positions *a′*, *b′*, *c′*, *d′* and *e′* are relatively close to each other. The pivot or guide ship F should thus be the one on the flank nearest the enemy in order to least disturb gun-fire in changing lines of bearing for tactical purposes. In each of the four quadrants of a circle about F as a center, the port battery will alternate with the starboard in being the better battery. These formations are worth studying, for it is on gun-fire that modern tactics must be based. Such sayings as "Gun-fire is everything" and "The best protection against gun-fire is a well directed fire from your own guns," are fundamental principles.

Few people realize the horrible destructiveness of modern gun-fire. Our fleet at Santiago accomplished what it did with less than 4 per cent of hits, and at that time our Navy had the reputation of having the best gunners in the world. Since then both ordnance and gunnery have been almost revolutionized, so much so that guns and methods good enough for 1898 are an invitation to-day to disastrous and bitter defeat. To illustrate how gunnery has improved and how terrible must be the hail of projectiles in a modern fleet engagement, let us briefly notice the recent progress made in the British navy in the matter of target practice. Let us take first the six-inch guns, as shown by the annual prize firing contest for 1901.

Each ship steamed at a speed of twelve knots and fired for two minutes with each six-inch gun, firing one gun at a time, at a target 20 feet long and 16 feet high, at a distance of nearly a statute mile. As published in the British press and verified by official reports, in 1901 the average of forty-eight British ships was nearly two hits per gun per minute. The best fifteen of the forty-eight made from two to four hits per gun per minute, but the best individual record was a string of eight shots and eight hits in one minute.


b
c
d
a'
e
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e

The record in the British navy for six-inch guns for the year 1902, so far as published (and the record is, of course, not yet complete), is as follows:

No. of Guns.	Name of Ship.	Shots.	Hits.	Per Minute.		Percentage of Hits.
				Shots.	Hits.	
12	Ocean	163	117	6.79	4.875	71
12	Crescent	139	105	5.79	4.375	74
12	Goliath	163	71	6.79	2.958	49
12	Terrible	109	66	4.54	2.750	60
10	Blenheim	84	50	4.20	2.500	59
12	Albion	117	57	4.87	2.375	48
12	Cressy	92	52	4.83	2.170	56
Totals.. 82	....	867	518			

In other words, 82 six-inch guns fired 867 projectiles in two minutes and made 518 hits, or nearly 60 per cent. The Ocean averaged nearly five hits a minute. One of her gun captains fired 9 shots and made 9 hits in one minute. This is easily the world's record, as it means less than seven seconds between aimed shots. One gun fired seventeen shots in two minutes and made fifteen hits. It will be seen that the percentage of hits does not determine the standing of a ship. It is the number of actual hits per gun per minute.

In smaller caliber guns one ship, in 1901, fired 159 shots in one minute from her 4.7-inch guns and made 114 hits or 7.5 shots and 5.7 hits per gun per minute.

In larger calibers, the Ocean this year made 68 per cent of hits with her twelve-inch guns, and one ship in the British navy has a record of 8 shots and 7 hits with her twelve-inch guns in five minutes and thirty seconds. Indeed, the established firing interval for British twelve-inch guns is about forty-eight seconds.

It is very evident that since gun-fire is intended to put out of action the battery and gun's crews of other ships that the gun positions must be well protected against such fire as is now possible, and which we have apparently not reckoned on. Can we afford to let such ships as the Kearsarge and Kentucky remain as they are with such large port openings and with their five-inch guns in open casemates? Even in the Alabama class, the gun-recoil cylinders are exposed to danger from small projectiles or fragments of shell. Must we not come to the foreign practice of mounting our five-inch and six-inch and seven-inch guns in closed or isolated casemates, each with its ammunition supply? In

our newer ships, the turret mountings are excellent, but we have sacrificed in the smaller guns the question of protection to that of numbers. We have always given our ships heavier batteries than corresponding types abroad, and we have kept pace with the progress in initial velocities, but I am beginning to think that the Germans have pursued the safer course in keeping their guns of standard pattern and of smaller calibers and lower muzzle velocities.

The British are experiencing great trouble with their guns in the erosion due to the use of cordite, which is a nitro-glycerine powder. Cordite has the advantage over the nitro-cellulose powder which we use, in that the charges are 40 per cent lighter than ours. This means quicker loading, for the charges weigh less and are shorter, and hence the shell is gotten home more quickly. In the British six-inch guns the shell can be pushed home by hand. In ours, a hand rammer must be used. The Germans use a nitro-glycerine powder and they have no trouble from erosion. Our powder gives very much greater velocities than the British or German, but the charges are from 30 to 40 per cent greater and our gas-check pads are not all they should be to stand the pressures. We have recourse, however, to metallic gas checks, and our troubles are no greater than those of other countries in these respects. Just now the Navy needs unusual and heavy expenditures for ordnance. Ships have been in continuous service from the pressure of the last five years, and everyone of them needs to come to a navy yard and get a complete overhauling as to battery and particularly as to ammunition, as they have on board a heterogeneous lot of brown powder, smokeless powder, and projectiles collected from various sources, most of it for the war with Spain. It is a pity we cannot meet the issue squarely and withdraw and destroy the whole lot, or at least get it into serviceable shape. We cannot hope to excel in target practice when the powder charges and sights do not correspond, when misfires and delays occur from poor ammunition, and when the gun-mounts themselves are in need of thorough overhauling. The problem of brass cases *vs.* loose charges; of metallic *vs.* plastic pad obturation; of electric *vs.* percussion firing; of the form and mounting of the telescope-sight and of its graduation; of the rapidity of elevation and train of guns; of loading at any angle of elevation—all these are but a few of the pressing questions in ordnance. In training men to shoot we are baffled by the continual change in the *personnel* of our ships; in the strain on officers and men due to the undermanning of our ships; in the constant drive to make an inadequate number of ships constantly shift about all over the world to meet political and other emergencies which directly prevents target practice; and also by inadequate appropriations for gunnery exercises. For the current year the appropriation for gunnery exercises is $12,000 for the entire Navy. We are now asking for $120,000.

The work of the Navy is not in the least understood by the country at large, and it is difficult to make its needs adequately appreciated. In the war with Tripoli and in the war of 1812, the record of the Navy was clear and unmistakable, because the Army did not figure. Few appreciate the part it played in the Civil War in breaking the backbone of the rebellion by the blockade it maintained, and in its services in the inland waters, because it was overshadowed by the splendid work of the

Army. In the campaign in the Philippines the Navy contributed largely to the ending of the war by the blockades it established, by the destruction of supplies and communications between the islands, and by its vigilant patrol of its long and broken coast line; but its services were not even mentioned in the recent amnesty proclamation, and the entire credit was given to the Army. In the next war the Navy must bear almost the entire brunt. There is a disposition in Congress and in the country at large to let up on our naval expansion. History teaches the folly of such a course, and reason tells us that we are courting humiliation. We need more officers and men, the batteries of ships being the basis of computation, and the battleships and armored cruisers the unit. A good many of the so-called cruisers on our list are little better than junk for our purposes, and they should be replaced by ships designed for scouting and auxiliary purposes. Such ships as we improvised in the war with Spain will not answer in the next war. It is to be regretted that we have not a regular building programme of battleships, but that is hoping for too much foresight.

In the study and formulation of the principles of tactics and strategy we may rest assured that the naval war college at Newport is alive to its responsibilities, and we may now confidently look forward to the day when a general staff will put the principles into execution in case of the appeal to arms to which this country seems to have the habit and for which it is apparently always unprepared. We cannot afford next time to trust to luck and an obliging enemy. There is a healthy realization in the *personnel* of our Navy to-day of our unpreparedness, and of the fact that other powers know it. We know very well where we stand in the matter of target practice. We need during the coming year $2,000,000 in ordnance and $120,000 in "gunnery exercise," instead of the usual $500,000 and $12,000, respectively. "Gun-fire is everything."

DISCUSSION.

"THE SIGNAL QUESTION ONCE MORE." See No. 103.

Commander J. B. MURDOCK, U. S. Navy.—As Mr. Niblack states, a proposed new signal code has been considered at the War College, but this of course is not open to public discussion. I wish, however, to refer to a few of the points presented in his paper.

It is possible that he somewhat over-rates the efficiency of our night signals. According to his own definition, "that method is best which is most reliable, and which is as simple and rapid as is consistent with absolute reliability." There can be no question that our present Ardois fulfils these conditions admirably up to a certain point. It is both rapid and reliable at short distances, but its limit is about four miles. The addition of a green light would complicate the mechanism, involve a change of code, and the difficulty of accurately separating the three lights in the signal would probably prevent any increase in the limiting distance of visibility.

For distant signaling, we must either use the searchlight or Very's signals. Both have good qualities, but are very slow. As rapidity is an essential, we may be said, therefore, to have no good system of distant night signaling, and we should face this as a fact and not remain content with our ability to signal well with the Ardois at comparatively short distances. Apparently the easiest way to overcome this difficulty is to adopt the "winker" system. This winker may be applied to a light of any power, placed at any height, and possesses therefore a practically constant rapidity at all distances. It is applicable to a search-light, or to a tallow dip. The only essential is a quick-working shutter. Our present method of pulsating the masthead light by breaking the current is unavoidably slow, not applicable to search-lights, and generally bad. Practically, the limit of speed attainable depends only on the quickness of the shutter mechanism. Although the Morse code is admittedly much faster than the Myer Army and Navy code, it is doubtful whether the advantage gained by its use in actual service is worth the trouble incident to the learning of a new code. During the recent army and navy maneuvers the Army Signal Corps experimented with heliograph day and acetylene night signals, and their signals were read by the ships, showing that if the Myer code is retained, our signal men can use the winker system without any trouble. The only question is, therefore, the mechanical one of making a quick-working shutter, and this should be easily met.

The objections to flag signals given by Mr. Niblack are so strong as to practically relegate the whole system to obscurity. Flags will probably be used, mainly because we have been brought up with them. It is unquestionable, however, that they do not fulfil their purpose efficiently, and it seems, therefore, hardly worth while to make any extensive change

in their use, such as might be advisable if they afforded the best system of communication. It is better to devote attention to some new system capable of meeting the new demands, than to waste time in attempting improvements on a confessedly poor system.

Should it be thought advisable to modify the existing flag system, Mr. Niblack's proposals are most timely. The only objection apparent is the possible error involved in remembering the change of the number of the signal, arising from the position of one special flag. It would be better, for instance, instead of giving a certain signal the number 13987, and then remembering that 13,000 is obtained by making the general recall the second flag of the hoist, to print the signal in the Signal Book as 9R87, and have R designated by the general recall. 12987 and 14987 would similarly be R987 and 98R7. The use of this nomenclature in ordering or recording signals will greatly reduce the possible errors.

Nearly everyone who has studied the signal question arrives sooner or later at the belief that future development must be found in the use of "shapes." What these are to be is another question, and over this there has been much discussion. The primary system is to use cones, spheres and cylinders, and hoist them like flags, but a short trial is enough to show that this method is impracticable from its clumsiness. Another idea is to have the shapes permanently aloft and to distend them by compressed air when they are to be displayed, but the slightest puncture of shapes or connecting pipes, by even a rifle bullet, would disable the whole system, and it is evidently unfit for use in action. I believe that the best, in fact the only, practicable system of "shapes" is found in the semaphore. Of its general utility, efficiency and practicability there can be no question, as it has been used in European signal stations and navies for years. It has probably been kept out of our navy by our devotion to the wigwag system, and by the advantage resulting in basing our Ardois, Very and sound signals on the same code. The latter is incontestable, and I should advocate no change; in fact, the 1, 2, code should be extended to cover the "winker" night system. This assimilating principle should, however, be kept strictly in its proper place as a convenience, and not be put on a pedestal and worshipped as a fetich. The question must be squarely met—in developing a new system shall we bind ourselves to special methods, utilizing the 1, 2, code, or are we at liberty to seek for the best system, even if it involved a new code? I am satisfied that the answer will be given in favor of the latter, although of course in reaching a final decision full weight should be given the disadvantages attendant on learning a new code.

If it is once admitted that the semaphore offers the best practicable method for signaling by shapes, we should adopt it. Then the above question presents itself. Shall we use the four-arm semaphore for the express purpose of applying the army and navy code, or is it better to adopt the two-arm, involving as it does the learning of a new code? The four-arm semaphore is actually installed on some ships. It is no argument to say that it works well; so will any other semaphore. Its advantages are apparently two only, viz.: it uses the Myer code and can be so

constructed as to show in all directions. The latter is most important, but is gained only by complex construction. The disadvantages of the four-arm semaphore as compared with the two-arm, are increased complexity, involving greater liability of injury; greater space necessary for display, requiring a long topmast; and greater probability of being shut in by smoke from the smokestacks. The two-arm, carried at the masthead, is free from these objections, but has the disadvantage of not showing in one plane. It is notorious, however, that it is used and most highly esteemed in the British Navy, and its simplicity and comparative immunity from injury are strong recommendations, while arrangements can be made, either for rotating the semaphore or for duplicating its display to allow of its being read from any direction. If it were not for our Myer code, it is safe to say we would never think of so complicated a thing as the four-arm semaphore. The question is, will the advantages obtainable in using this code outweigh the clumsiness of the apparatus? I believe not, and think the two-arm superior.

Mr. Niblick says we do not need the British semaphore, and that he has seen the wigwag flag used like lightning. My dissent from his conclusions is probably due to our different points of view. I do not consider the semaphore as an alternate to the wig-wag flag, but as a substitute for the flags in the general code. We need the semaphore for battle signals, not for wig-wag. Once introduced as the most reliable instrument for general code signals, it can fight its own battle with the wig-wag flag in actual service, and the best will win. No one can say that signals will not be made in battle, and we must therefore provide the most efficient system and best instrument possible. In my opinion this calls for the two-arm semaphore.

Lieutenant-Commander Bradley A. Fiske, U. S. Navy.—I agree with Lieutenant-Commander Niblack in nearly all the important matters covered by his paper. Particularly do I agree with him in the belief that we must not change our code. The time for changing the code has long since gone by. There comes a time in every organization when the arbitrary signs that are used by it become part of its language; and when that time has come, it is impracticable to change them. For instance, it is impracticable now to change the letters of our alphabet, or our system of weights and measures.

Before considering so important a question as any change in signals, it is necessary to consider where the present system is good, and where deficient. Let us make no changes except where needed; let us scratch where it itches.

From my own experience, I feel sure that for nine-tenths of our purposes the present systems of signals are perfectly adequate. For ordinary squadron routine work, over short distances, and among a few ships, and in good weather, the present flag signals, re-inforced by wig-wag signals and the megaphone, do all that is required, in the sense that it is very rarely that the operations of a fleet are handicapped, under these conditions, by defective signaling. This remark applies to night signaling, as

well as to day signaling, and I cannot recall any instances where the operations of a fleet have been seriously handicapped by defective night signaling.

Fog signaling, under the present system, seems about as good as fog signaling can be, unless wireless telegraphy be used.

But there is one condition under which our present method of signaling is very, very defective, and that condition is the condition in which a large fleet is to be handled, when spread over a large area, in which the various ships are distributed in various directions from each other. In other words, the condition under which our present method of signaling is defective is the condition of a large fleet operating in the presence of the enemy. This is the only condition which we have seriously to meet; but we have to meet this condition urgently, because it is the condition under which ultimate victory or defeat will be decided—perhaps very soon.

It is the experience of every naval officer that the real cause of trouble in signaling is due to the flags themselves, either when they hang up and down the mast, or when they are blown out in the wrong direction. Every naval officer has seen the operations of a fleet very seriously handicapped by these things, and knows that the trouble increases with the distances over which the ships are separated, and with the number of directions in which the ships bear from each other.

Now when we limit our study of the subject to this part of it, which is the only part requiring it, the problem becomes very simple. It is merely that of making a few hundred tactical signals which can be read in all directions at the same time.

It is unnecessary to add that these signals should be reliable; but it is pertinent to point out that the best way to make signals reliable is to make them *repeatable*; that is, of such a kind that the ship which reads a signal repeats it at once, thus showing, beyond a doubt, that she understands it, and also repeating it to other vessels too far away to see it. Repeatability seems to me a *sine qua non* of accurate signaling.

I have made experiments for many years with many different kinds of signals, and I have ascertained that, weight for weight, area for area, the most readable signal is of the nature of a line that can be put at different angles; every naval officer knows, for instance, how quickly he can tell, over a great distance, whether a topgallant yard is square or cockbilled. In other words, the ideal kind of signal is some form of semaphore.

I do not wish to be understood as meaning that I disbelieve in flag signals. I believe in flag signals; they are good, and for reasons which all naval officers know; but I believe that they should be merely an auxiliary to some form of semaphore, to be used only if the semaphore gets out of order. I must beg the kind indulgence of the Institute for my seeming egotism, if I state that it is my sincere belief that the four-arm semaphores, which have been in continual and successful use in the Kearsarge and Alabama for nearly two years, fulfill all the purposes of day signaling; or, at least, that they would do so if they were used suffi-

ciently to give the operators and readers practice, and if their use was extended in the very simple way about to be described.

At present, one display indicates any one of 30 characters; that is, it gives any one of 30 signals. This display can be made almost instantly, and it can be answered and repeated in 15 seconds by all ships within the range of visibility. Two displays can be made and repeated in 20 seconds more, so that any one of 930 signals can be made and answered in 40 seconds, outside limit. Now 930 signals are all that any fleet needs for operating in the presence of the enemy; and these signals are readable in all directions. At the risk of being accused of unnecessary reiteration, I wish to reiterate the statement that *any one of 930 signals can be made by any ship in a fleet and answered by all of them, no matter in what various directions they bear, or what the direction or force of the wind is, in 40 seconds.* This being true, why is it necessary to resort to radical changes, with all the demoralization that radical changes bring?

A few months ago at Trinidad, a semaphore signal made by the Kearsarge was easily read on board the Massachusetts by a signal boy, when the ships were six sea miles apart. A large telescope was used to do this; but the fact is that it was read without the slightest difficulty, when the weather was not very clear, and it could easily have been read at least ten miles.

I have purposely omitted including wireless telegraphy under the head of naval signaling, for the reason that, while it will be extremely convenient for all the ordinary purposes of fleet work, I am sure it possesses the inherent defect that, if used in the presence of the enemy, the enemy can interfere with its indications by sending out Hertzian waves themselves.

I have also purposely omitted describing a method by which one display of semaphores can be made to mean one of 80 characters, instead of 30 as at present, because I do not think it necessary, and because, with an increased number of arbitrary symbols to be memorized, there comes increased liability to mistakes. And I consider the most important feature of any signal system to be freedom from liability to mistakes, either on the part of the mechanism or of the men who use and read it.

In my opinion, the subject of protecting the signalmen forms part of this subject. The ideal system would be a semaphore operated electrically by one man below the water line. To do this would be easy, very easy indeed. No signal system is worthy of our present battleships which puts the signalmen on an exposed bridge. If the semaphores be operated electrically, as was done with the four-arm semaphores in the New York in 1897, the time of making and repeating any one of 930 signals will be reduced from 40 seconds to 20 seconds.

The advisability of having at least two signal masts on every ship is apparent, when one considers the chance of the signal apparatus on one mast being damaged in action. With semaphores on each mast, electrically operated from below the water line, the damaged semaphores on one mast could be switched out, and the other switched in, as easily and quickly as a telephone at "central."

The significations of "Preparatory," "Compass," "Numeral," etc., can be given to any signal by "pulsating" one or more of the semaphore arms. Pulsating the upper arm could mean "numeral;" pulsating the second arm, "preparatory;" pulsating the third arm, "compass;" pulsating the fourth arm, "end of signal;" pulsating the first and second arms together, "use navy code;" first and third arms, "ship's letter," etc.

This plan fulfils all the purposes of navy signaling. If we restrict ourselves for a while to what is urgent, i. e., tactical signals for use in the presence of the enemy, it is merely necessary to select 930 signals from the General Signal Book, and publish them in a Tactical Signal Book, in which they shall be given alphabetical as well as numerical designations; for instance:

Signal No.	Signal letters.	Maneuver.
915	W. T.	....
916	W. U.	....

It is merely necessary to direct that signals shall not be preceded by any explanatory display, and the system is complete. Suppose for instance it is desired to signal "*Get underway,*" and that this is denoted in the Signal Book by *AB*. A is signaled and answered; then B is signaled and answered. The fourth semaphore arm is then pulsated, showing that this is the last display, and all the arms are dropped; which corresponds to the hauling down of a general flag signal. Suppose the signal were "*Prepare* to get underway." The same procedure would be followed, except that the second arm would be pulsated, on the first display of A, indicating that the signal was "preparatory."

It would seem that semaphores should be electrically operated in large ships, and mechanically operated in little ships and torpedo boats.

The four-arm semaphore system can be used for other signals besides tactical signals, by simply making more than two displays. Three displays, for instance, will permit of more than 27,000 signals; and these can be made by the mechanical apparatus on the Alabama and Kearsarge in less than 30 seconds, and by the electrical apparatus in less than 15 seconds.

At the risk of being called "facetious," but with the sober intention of pointing out the capacity of the four-arm semaphore system, I will add that any one of *810,000* signals can be sent by four displays in 20 seconds; and any one of *24,300,000* signals by five displays in 25 seconds, etc.! Besides this, the system can be used, as at present, for "wig-wags."

Inasmuch as these signals are readable in all directions, are repeatable, and are independent of the force and direction of the wind, it may be asked, "what more is wanted?"

Lieutenant-Commander R. C. SMITH, U. S. Navy.—The signal question, as Lieutenant-Commander Niblack intimates, is suffering attack from all sides. Without going into the merits of the system that has been under discussion at the War College, it may be said generally that the need at present is for simple and effective day and night battle signals. If the few most urgent battle signals can be made simply and


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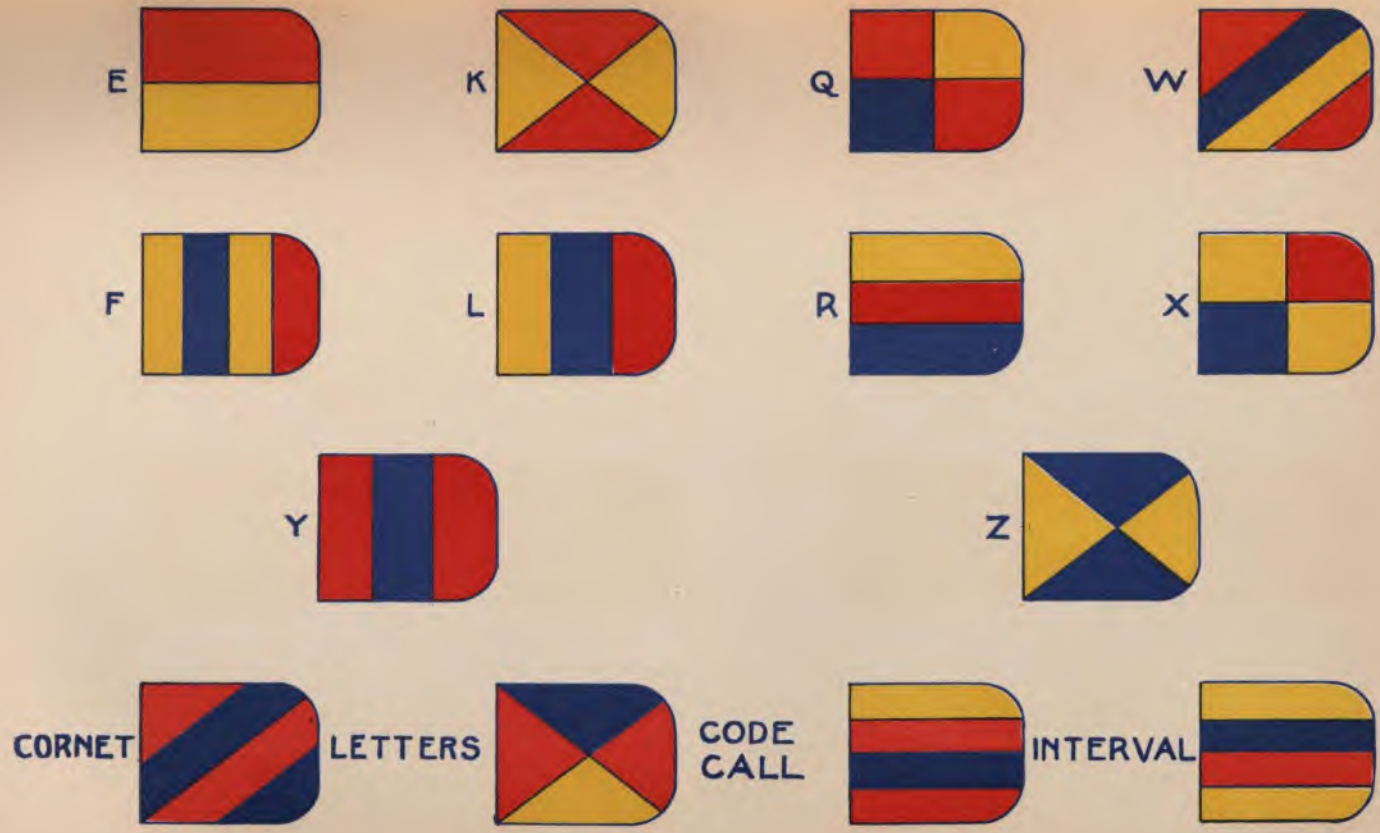
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CORNET
LETTERS
CODE CALL
INTERVAL

quickly in a number of different ways, then the rest of the signal question may be left to work itself out on lines of least resistance.

In considering any changes that may seem desirable, it is wise to keep in view a universal truth; that is, that it is safer and simpler to remedy, and add to, and harmonize an existing system, than to throw everything overboard and start afresh. An entirely new system would probably develop as many faults in practice as an old one, and it could not be in thorough working order for a number of years. A board to consider battle signals and tactics has recently been in session in the North Atlantic Squadron and has submitted a comprehensive report. Judging from the number of concentric attacks on the signal question, it would seem to be the part of policy to bring together in the near future a representative board from the different factions to consider the whole subject. Such a board could be made up of members from the War College, from the principal squadrons, and from the Department. It should not be so large as to be unwieldy.

The North Atlantic Squadron Board took this general position. The first need is battle signals. They should be as few as possible, as simple as possible, and should be capable of transmission in many different ways, and in whatever way transmitted should always use the same code. Also to avoid radical changes, the present navy codes were to be retained at all hazards. The board found that the really urgent battle signals would not exceed about 26 in number, that they ought to be capable of transmission by flags, day semaphores, night electric, and distant signals, by a single flag or display of a uniform code, and that the same code should be used in sound, flash-light and search-light signals, in day fireworks, and possibly also in a modified Very system. This led irresistibly to the Myer code. It is used now in most of the above methods of signaling, may be applied easily to distant signals and day fireworks, and possibly also to Very signals. To apply it to a flag code required a little thought, but a method was devised similar to the present alphabetical distinguishing pennants of the navy, which are based on the Myer code. As the flags were to be used singly, for battle signals only, they could be made large (10½-foot hoist), and by adopting a number of different forms or groups in the arrangement of the colors, they could be made sufficiently different from each other, and different from any present navy or international flag or national ensign. The different forms used were horizontal, vertical, and diagonal stripes, and checkerboard and diagonal quarterings. The colors are read from top down, from hoist out, or in the quartered flags, around clockwise (assuming the hoist on the left), beginning at the hoist, or upper hoist color, and so on around. They have the advantage that they are intelligible at once, and do not have to be memorized.

Cones and drums, or pennants and square flags, on the Myer code were recommended for distant signals, and similar shapes for day fireworks. Having thus harmonized all the codes, there was nothing else to do except give an additional alphabetical designation to the first 26 numbers of the signal book. (Some transposition was necessary to get the urgent battle signals in the first 26 numbers.) Then one of the above described battle

flags, or a single display of the night electric, or day semaphore, or distant signals, meant that particular battle signal.

The board did not recommend doing away with the present numeral flags, or the numerical arrangement of the signal book, which it thought would be a great mistake, but it endorsed Lieutenant-Commander Niblack's idea of introducing the special flags into the hoists to increase the range of signal numbers, and thus make all signals general.

In conclusion, I am in general accord with Lieutenant-Commander Niblack's contention that we have a good, practical signal system, and I believe it is much better to harmonize it, and add to it in small ways, but without change of principle, than to throw it over for something radically different.

Lieutenant-Commander R. T. MULLIGAN, U. S. Navy.—Having been invited to express my opinion upon Lieutenant-Commander Niblack's article, my first impulse is to state that I am opposed to any change of code, until such time as it is shown that those now in use will not do the work required of them. As Mr. Niblack is a thorough master of the subject with which he is dealing, I mean, as far as practicable, to abstain from comment upon the changes he has suggested. What seems of the most vital importance now is to avert the predicted panic that would certainly be caused by the sudden adoption of the new codes outlined in his opening paragraph. The existence of a scheme to make radical changes in the present codes, if not to upset them entirely, was revealed to me by the carefully prepared article under discussion. I have been living in the firm belief that the service was satisfied with the codes now in use.

A little unwritten history, showing how our night signal codes gradually assumed their present state of usefulness, may be of interest to some of the officers of the service, and, at the same time, warn those who are fathering the "experimental code" of the great danger to accrue from increasing the number of *elements* in any method of making signals. I refer directly to increasing the number of signal flags, adding the green lamp to the electric night system and the white star to the Very pistol code.

Very's night signal system was adopted by the Department, if my memory serves me correctly, in 1876, and although it is slow, I believe it to be the best and most reliable now in use by any nation for long-distance night signaling. In the original code, submitted, I understand, by Lieutenant Very, the numerals were indicated by groups of three stars (red and green), so that the number of possible combinations made it necessary to represent the 9 and 0 by a star followed by a bracket. That is, $9 = \frac{(R)}{(G)}$ and $O = \frac{(G)}{(R)}$. Bracketed stars, in combination with rockets were also used, as now, to indicate the Telegraphic Dictionary and the Geographical Lists. As no *divisional point* or *interval* were provided for in the code, it can be readily seen that signals from the lists mentioned were rarely, if ever, attempted, except for purposes of exercise. This system and code

were such a distinct improvement over the Coston lights (then in general use) that both were accepted as being practically perfect. The system, however, was seldom used, except for making vessels' numbers, until 1883, when the vessels of the North Atlantic Station, under the command of Rear-Admiral Cooper, were assembled and ordered to cruise in squadron. It was then found, almost at once, that the pistol supplied was dangerous, and that the paper cartridge shells split after being reloaded a few times. These defects were met with an improved pistol and by loading the stars in metal cases. It was soon noted that the stars, after being on board ship for a few months, rapidly deteriorated. They would split when fired, and show two stars in the air at the same time. This was contrary to the rules of the code, except for bracketed stars.

The action of the weather, especially in the tropics, caused the stars to lose their color. The red faded out to a light pink and the green appeared as white. In consequence, the split stars were often recorded as brackets and the single stars, under certain conditions of the atmosphere, were indiscriminately recorded. The Department took action by having the stars more carefully sealed in the shells, and by wrapping the spare stars in oiled paper and sealing them in water-tight boxes. Later, in Washington, carefully conducted experiments were made with stars of various colors. Pink, blue, violet and white (yellow) stars were tried alone and in combination with red and green. The introduction of a contemplated *third* element had to be *abandoned,* for under certain weather conditions the reds and pinks, the pinks and whites and greens, blues and violets were incorrectly recorded. This is what actually *did* happen, and what is bound to happen again if "a white star is interjected" into the code. The present system of *numerals* and the *interval* were devised to do away with the bracketed stars in the 9 and 0, and to make it possible to properly point off the whole numbers in a string of stars representing a telegraphic message. This code, practically as it stands to-day, was then tested on the North Atlantic Station and was used, though not officially recognized, for night tactical and drill signals, until the Ardois with its five lamps and its 64 displays, with its arbitrary and cumbersome code, was installed upon the vessels of the Squadron of Evolution, commanded by Rear-Admiral Walker. Mr. Niblack very aptly says, "what is everybody's business is nobody's business," and, for this reason, it was not until several years later that the present instructions for the Very's night system were issued to the service in the form of a general order. Speed in all systems is desirable, but it should never be obtained by introducing an element of danger. The system in question is now only used for making distant signals, and speed is a matter of little or no importance; the four-lamp electric system has displaced it for tactical and drill purposes.

Almost the same objections hold against adding a green lamp (a third element) to our electric system. Under certain atmospheric conditions white lights appear as red, and, more frequently, green as white. It is not so many years ago that a ship of our navy was lost, because a white light, seen through a fog, was taken for and believed to be a red one. Many of the readers of this publication must have noted the reddish tinge

of our white masthead speed light, when seen through a mist, or, what is much worse, through the smoke of another vessel in the formation. I assume that the idea of introducing another colored light into the electric system is similar to the one tried and abandoned in the Very's system; that is, to reduce the number of lights in each display from four to three. I doubt if the danger of placing a red and green light in close proximity, where their rays will blend, has been carefully considered by the sponsors of the new system. Red and white lights were selected for the electric system because they interfered the least with one another, and because experiment has proved that they have the greatest range of visibility during all weathers. If the third colored light is introduced, and the rule to repeat all displays (which means a loss of time) is not strictly carried out, we simply invite disaster. A mistake in recording a signal lamp in a tactical signal might lead to a collision and, incidentally, the loss of a ship. I believe that the present system is the best because it is the simplest, and because it is by all odds the safest.

The reason for giving up the English and American Morse codes, and adopting a modified Myer, have been too well threshed out in the pages of the Naval Institute to need further comment. By so doing the navy secured a safe code for fog signals, and the *time element* was eliminated from the visual code. It would, to my mind, be no less than madness to change back again. The reasons were good ones, or the changes would not have been effected, and these same reasons still obtain. If experience has shown that the Army and Navy code can be slightly changed for the better, it should be done; but not until, as Mr. Niblack intimates, the Signal Corps of the army has been given an opportunity to consider the proposed changes and has agreed to effect them simultaneously with us.

Why adopt a flag code having 53 elements, when we now have one of 30 that will do all the work? If it does not, do not blame the code until it has been given a fighting chance. The code can be made to do anything. The chances of error in making out a flag signal of three flags, made with a code of 53 elements, are mathematically greater than in a four-flag hoist, made with a code of 30 elements. The service would welcome a code with a lesser number of elements than 30, provided it is one that will do the work. Let us endeavor to simplify our codes. The compass flag can be abolished by a rearrangement of the signal book. It would be an easy matter to set aside 128 numbers, below number 1000, for compass signals. Any greater refinement than quarter points can be signaled by a general signal, followed by a numeral, indicating the degree from 1 to 360.

It is the popular belief that sailors are long sighted (men living a great deal in the open air usually are), but even this generally accepted fact seems to be open to question. Darwin, in "The Descent of Man," makes the following statement: "It is a singular and unexpected fact that sailors are inferior to landsmen in their mean distance of distinct vision." Dr. B. A. Gould (Sanitary Memoirs of the War of the Rebellion, 1869, p. 530) has proved this to be the case, and he accounts for it by the ordinary range of vision in sailors being restricted to the length of the vessel and

the height of the masts." The above would seem to add to the list of reasons for not wishing to increase the number of elements (flags) in the flag code. With 53 flags some of the color combinations will of necessity be dangerous. From the report of the Committee on Color Vision of the Royal Society, dated April 28, 1902, I cull the following facts, which I believe will strengthen the position I now take. It states that experiment has shown that every color in nature, as seen by a normal eye, can be expressed by a mixture of three. The yellow of the spectrum, for example, cannot be primary, for it can be matched by a suitable mixture of red and green. This alone seems to be a fairly good reason for not wishing to get a green light tangled up in our electric system. Each of the primary colors has its own color sensation, and this force, if it can be so called, will be stimulated or reduced by being placed in combination with another. The flags of our code are nearly all of but two colors. With the one proposed many of them must be of at least three. On purely theoretical grounds alone, trouble seems to be invited.

I believe Mr. Niblack sounded the correct alarm by calling the attention of his readers to the fact that anybody can "send" signals, but that it requires an expert to read them. It is undeniable that the English and French entirely outclass us in expertness in making and reading signals, the former on account of the rapidity with which they work their semaphore by day and winker by night; and the latter, because they have drilled their people to pick out, bend on, hoist, read and haul down flag signals, made by a cumbersome code having 51 elements, with the least possible delay. Both nations have specially trained men to do signal work. The question is naturally asked, why cannot we do the same? If we have, as Mr. Niblack states, the best code in the world, why cannot we excel them? For the answer, but with fear and trembling, I refer to the navy pay tables for enlisted men. The reason is there. It will be noted that a chief quartermaster, who is the custodian of all the signal stores of the ship (as well as of many other articles for which the navigating officer is held responsible), and is supposed to be an expert signalman, receives but $50.00 per month. Compare his pay with that of others, who get as much and more than he does, and then compare their respective duties and responsibilities. It seems to be absolutely unnecessary to enter into details. Chief Quartermaster is the highest rate that can be attained by an apprentice, selected originally for his quickness of mind and natural brightness, provided he makes up his mind to stick to the erroneously so-called "Signal Staff." Let us assume that a boy has, in due course, been rated an apprentice first class, and that in the last year of his minority a vacancy occurs (on the vessel upon which he is serving), and that he is given an acting appointment as quartermaster third class. This is the best that can be done for him in this line. Openings occur in the other branches more frequently, and are naturally more attractive on account of the pay. It seems to be the policy of the Department to offer every inducement to enlisted men to qualify in one or more special branches, and to give them certificates which carry with them two dollars per month in addition to the pay of their ratings. (See General Order No. 108, dated September

11, 1902.) Why not a certificate as *signalman?* I do not mean to create a separate and distinct class of people on board ship who would only admit that they belonged to the great whole when the word was passed for liberty or monthly money, but simply to grant a slight increase in pay to boys who are sufficiently well equipped to be placed upon the signal detail. I would have this gratuity small, graduated from one to three dollars, and to be awarded only during such periods as a boy was actually upon the signal detail, and that he continued to qualify as a "signalman." I am of the belief that some such scheme, as I have briefly outlined, will at once ensure a great deal of voluntary signal exercise, and as Mr. Niblack states, "practice can alone make perfect." We have tried the plan of making *all* enlisted men of the deck force competent "signalmen" and it has dismally failed. If we had a *real* "signal staff" there would be fewer complaints about our codes. Signalmen, if we are ever to have them, should be trained in all the duties of a quartermaster and with a view to their being made such. The necessity for having intelligent and reliable men for quartermasters is greater now than ever before. The junior officer of the watch is a dream of the past. The quartermaster now does most of the former midshipman's work. In small vessels, where the number of watch and division officers makes day's duty a necessity, the quartermaster is, in port, the *de facto* officer of the deck. A good "signalman" can be made a good quartermaster. I am sorry to say that the converse is often not the case. It is to be regretted that we have in our service to-day a number of men holding the rate of quartermaster, who know no more about signaling than they did the day they entered the navy.

Let us keep the present codes until we have tested them in the hands of a properly equipped "signal staff."

Lieutenant-Commander W. F. Fullam, U. S. Navy.—I have read Mr. Niblack's paper on signals, and I consider that his argument is absolutely conclusive. There is nothing more demoralizing or discouraging to the personnel of the navy—officers and enlisted men—than frequent changes in signals, tactics, etc. At the present time such changes would work great mischief and should be resisted. The navy has many serious problems on its hands. It cannot afford to inflict a single ***unnecessary burden*** upon every officer and enlisted man in the service! There are many *necessary reforms*—enough to occupy us for years to come—and it does not appear that the proposed new signal system would be an improvement. On the contrary, it would seem to be a decided step to the rear—not a simplification, but a complication of the signal question.

Mr. Niblack has demonstrated that our present system can be simplified somewhat, and he has clearly shown how to do it. He has shown that we can adapt our present codes to all ***new*** systems—winkers, semaphores, wireless telegraphy, etc. ***We can adopt the good features of all foreign systems without making any material change in our own!*** We can bring our present system to the top notch of efficiency without nagging the life out of hundreds of officers and thousands of men! What, then, is the **justification for revolution?**

It may be well to point out that we can use the English "winker" at night, without interfering with our mast-head speed lights, by simply tricing up a good strong electric light at any convenient place *below* the speed light. And we might adopt *blue, green, pink,* or any other color, for this "winker." in order to distinguish it absolutely from all other lights or signals! In this connection let it be noted that the Myer code—the Army and Navy code—is a sort of signal *octopus* which can gather in, absorb and utilize about everything *that is of any practical use for signal purposes!*

To suggest a change in the signal system which would compel the army to begin over again would demoralize the military as well as the naval service.

To summarize, Mr. Niblack has demonstrated that we should proceed as follows:

1. Simplify our present system.
2. Adopt a special battle code.
3. Develop shapes.
4. Develop wireless telegraphy.
5. Perfect the semaphore if possible.
6. Do our duty by exacting a proper use of our present system.

Lieutenant-Commander Albert Gleaves, U. S. Navy.—1. I think it would be most unfortunate and undesirable to make any radical change in our present code of signals, except in the ingenious and clever manner suggested by Lieutenant-Commander Niblack, especially since the proposed changes tend to complication.

2. I also believe that the four-arm semaphore for long-distance day signaling approaches more nearly what is desired in the service than flags. Under some circumstances flags are better, but the great trouble with that system is, that frequently at distances of only a few hundred yards it is impossible to read them. This is a common and familiar experience.

3. If, however, the semaphore is developed to its full capacity by practice and controlled electrically it is difficult to see how it can fail to give entire satisfaction. Further, it has a very great advantage in the fact that the key-board can be placed in a protected position and signals made without exposure of the operator, and the bridge thus cleared of a lot of people who aside from being exposed are very much in the way.

4. The special advantages of the four-arm semaphore are:

(1) It is readable in all directions at any given instant.

(2) The arms are pivoted at the centre of figure, thus being balanced for all wind pressures, and workable in all winds, and yet of very light weight. If they were not pivoted at the centre, the wind would bind them in the pivots. This would mean heavy, long pivots, very strong semaphore arms, very great weight and very slow motion by gearing.

(3) Repeatability with quickness.

5. In this connection it is not out of place to call attention to an aid in reading signals that has been invented by Lieutenant-Commander B. A. Fiske, consisting of a powerful telescope and mount designed to be carried

on board ship. It can be readily operated and anyone who has seen it cannot fail to be impressed with it as a valuable addition to the equipment of our warships.

6. It should not be forgotten that the signals in use to-day and the glasses and the telescopes also are practically the same used in the days of Hawke and Rodney.

7. It would seem now as if the problem of signaling at sea either in peace or in war is very close to a practical solution. At Copenhagen, Nelson could not read the signals from the flagship because he put his glass to his blind eye; it behooves us that we do not continue to have blind eyes when the new glass and the new signals are at hand.

Lieutenant W. J. Turpin, U. S. Navy.—I so heartily agree with the author that I cannot say anything that he has not already said, and I only wish to emphasize one or two of the points that he has made.

Our present signal code seems to me to be about as good as we can possibly get and all of our efforts should be bent to simplification rather than to complication which seems to be the result of the adoption of the proposed code.

The hand semaphore is undoubtedly a good thing, but is not our wigwag equally as good except in the one point of speed? Should we adopt a signal code simply because it possesses the one doubtful advantage of having speed? No, and a thousand times no, when that code cannot be applied to any of the other systems in use for night or sound signals.

Lieutenant-Commander A. P. Niblack, U. S. Navy.—Brigadier-General A. W. Greeley, Chief Signal Officer of the Army, asks me to say that the reason the American Morse code was adopted by the army in place of the Continental Morse was that the latter code is un-American and unfamiliar to ordinary operators, and that the army took up the modified Myer merely as a concession to the navy and for the sake of uniformity. The army had no fault to find with the American Morse code.

The recent General Order of the Navy Department paying acting signalmen extra money is a direct result of this agitation of the signal question, and as the sentiment of the service is strongly against any change in the codes we have, it is not probable that the proposed changes will be considered seriously. There must be a revision of the tactical signal book, and then will be a good time to simplify the flag code.

The Fiske four-arm semaphore is successful, so the real need of the service seems now to be a shutter for the "winker" light. The "winker" light is now, and has been, a part of our code, and what is wanted is a successful shutter.

I am certainly very much obliged to Commander Murdock and Lieutenant-Commanders Fiske, Mulligan, Fullam and Gleaves for their discussion of the paper. These are all I have seen, and they leave nothing further to be said.

"THE DEFENSE OF OUR NEW NAVAL STATIONS." See No. 102.

Commander E. B. BARRY, U. S. Navy.—I have read the article by Captain Dion Williams, U. S. M. C., on "The Defense of Our New Naval Stations," carefully and attentively several times and fully agree with it.

Whatever may be the faults of the French, certainly military administration during most of their national history has been of the best. They have been among the first to recognize that a colonial force outside the regular military establishment was necessary and the Infanterie de la Marine on many a field and in many an uncomfortable station have demonstrated the wisdom of their military rulers.

We are entering upon an epoch new and unique in the history of our country. Until within a few years we had but one colony and that not known to the majority even of our educated people. Now how different. Forced by the inexorable mandates of political circumstances we find ourserves possessed of an empire which is colonial and must be so regarded by every naval officer and marine officer that has observed the tremendous changes of the past four years.

It was the fashion before the Spanish war to relegate the navy to the obscurity due an inferior and worthless factor in the military defense of the United States. The opinions of the most thoughtful writers in Europe on national defense and the accepted dicta on sea power of Mahan were treated as flippantly as the gravity of the subject deserved, but the object lessons of facts could not be ignored. Few experiences were more convincing than the effect produced upon the expeditionary force destined for Santiago by the unfounded rumor of the proximity of the Spanish fleet to Havana. It is hoped we have learned now where and what is our first line of coast defense.

I think neither the navy nor the Marine Corps can be accused of grasping for what does not belong to them, but the peculiar military situation at Peking to which Captain Williams calls attention might be referred to in connection with the captures of Ponce and Iloilo.

Whatever may be the future of our power in the East, every thought, every idea, every consideration of national policy demands that all naval bases must be under the absolute control of the Navy Department. Unity of command is so essential to success that even to mention it is almost an insult to the military mind.

The dividing line between the army and the navy is at the point where the essentials of the two services separate; hence, logically, what the navy needs ashore for its safety, its preservation and its rehabilitation must be controlled by the navy, and who can deny that navy yards and coaling stations are not essential to a navy?

In a serio-comic article on War-insurance written some years ago Commander Kimball mentioned the various navies in which the United States loved to indulge; but when the stern arbitrament of war comes to settle this question, the A navy and the B navy and all the other seven or eight navies we may play with will depend upon what I call the navy-navy for their very existence.

Part of this navy-navy is the marine corps, and I take it the soldier-sailor is to be the collaborator of the sailor that mans the ship.

We hear a great deal about the strides in military education, but the most perfect soldier is not a sailor any more than is the most perfect sailor a soldier, and we must recognize the differences.

It would add materially to the efficiency of the marine corps were all the additional officers in the future to come from the Naval Academy. This, however, seems hardly possible in view of the failure of the effort to increase the number of students there to meet even the immediate pressing needs of the line. It is evident that the younger officers of the marine corps appointed from civil life must be taught the rudiments of their profession after appointment, whereas the Naval Academy graduate would be competent to enter upon his duties at once, at a great saving of time, trouble and inefficiency. Should the marine corps be increased to 15,000 men it is almost certain that nearly all vacancies thus created will be filled by civil appointment.

I agree with Lieutenant-Commander Fullam's idea about the marine transports, only great care must be exercised to avoid overcrowding them. Of course these transports should be equipped with a full landing outfit, including extra guns and transportation facilities of all kinds adequate to the force aboard.

I would employ the marine corps as our naval colonial military force; garrison all naval bases and coaling stations abroad with marines; prepare and keep intact a mobile expeditionary force on each station and in the event of war embark it.

Taking Lieutenant-Commander Fullam's allowance of three transports in the East we could have from 1500 to 2000 men always available. I would not station these detachments permanently aboard the transports, but at certain designated posts I would establish camps of instruction where the force would be instructed practically in all the duties likely to be required of them. At stated periods the organization should be embarked and cruise for a definite time, a descent should then be made upon one of the regular posts and the landing and defending operations carried out in full. By these means the whole organization would be kept in a state of readiness. The details easily are worked out.

First, last and all the time, everything on the station, be it coal depot, naval base or rendezvous, should be under the control of the station commander-in-chief.

Lieutenant T. T. Craven, U. S. Navy.—Lieutenant-Commander Fullam's arguments regarding a marine transport system are certainly very forcible, and if the scheme could be worked out as he plans, it would undoubtedly be one of great benefit, but it seems to me that there are serious practical difficulties that stand in the way of such a plan being evolved at the present time or for some time to come in our navy.

In the first place, it is frequently the case that, as on the Isthmus, where local disturbances are common, that it is necessary to have a small force at hand ready to land at any moment, and I think our present arrangements which permit a landing party being thrown ashore from any ship good.

The presence of a large body of men might be unnecessary and the expense and discomfort incident to keeping them in such a locality unwarranted.

Of course all that Lieutenant-Commander Fullam says about crippling a fighting ship by landing parts of her crew is entirely correct and has been recognized by commanders of fleets and ships for many years, but, nevertheless, the past four years have shown us that a ship of war must have an armed detachment ready to land at any and all times and under circumstances when no fleet commander could have foreseen the contingency. If she has not such a landing party organized the presence of the ship may be of no avail and the public interests suffer accordingly.

(The Boer war and the recent disturbances in Samoa and China come under this category.)

In conducting a naval campaign the value of the presence of an efficiently organized landing party with the fleet cannot be over-estimated; still it is my opinion that for the general service which the navy is called on to perform the present arrangement is a practical one and its results quite satisfactory.

If we had six or eight large vessels, each capable of cruising at twelve knots in cargo, that could carry five thousand tons of coal for the fleet, and having such accommodations that, with a lesser amount of coal, a thousand men, their supplies and field pieces could be transported, it seems to me that our commanders-in-chief would be furnished with something more valuable than transports for marines alone.

These collier-transports would be all the more valuable if on shore at certain points, say two on our Atlantic, one on our Pacific coasts, and one in our Philippine possessions there were headquarters for considerable bodies of marines ready at all times and drilled at embarking in and disembarking from transports.

With this plan it would only be a question of hours before relief could be sent to any vessel requiring it and the marines who were to serve on shore would be on dry land where they could receive the proper instruction and drill for their work.

It is my belief that sailor men can do the work of marines on board ship, and equally well, but I do not think that a marine guard in any way lessens the efficiency of a ship as a fighting unit. It seems to me that just at this time in our navy we should oppose anything that tends towards further radical changes.

At the present day we suffer from the results of an unstable policy and want of system in our service, and what we need a thousand times more than anything else is stability.

When we have a large homogeneous fleet with men, ships, and money to spare, it will be time to introduce transports or ships for marines alone, and until then it seems to me it would be better to continue on the present system, retaining marines in the fleet, garrisoning our naval stations and bases with them, and in addition establishing the headquarters before mentioned where both men and officers would get their training and experience from maneuvers and exercises carried out on a large scale.

"The Employment of Petty Officers in the Navy." See No. 103.

Commander Henry McCrea, U. S. Navy.—In reading over Mr. Fullam's excellent article on the Duties or " Employment of Petty Officers in the Navy," I was pleased to note the stand he tood regarding schools for petty officers. However good schools might be for training electricians, yeomen, cooks, &c., I am sure there can be no better place than sea-going ships as schools for our regular line or executive petty officers. There is one step we might take with advantage, and that is to define or standardize the duties of each class of petty officers. A school like that at Newport might establish the standard, and even formulate, generally, the duties. For example, all line petty officers should be obliged to conduct the drills, not only the setting-up, but the gun drills, small arms, boats, signals, even as far as aiming drill and sub-caliber small-arm target practice. All this under close supervision at the start, and, if possible, with progressive steps. Leading men in our service should be *expected* to lead, and unless definite responsibility be given them, we can hardly expect the best results in emergencies. Smart ships are made possible to the service by rivalry frequently, but are more lasting when created by contentment and *esprit de corps*. I refer to the corps of petty officers and leading men. How satisfying it is to see men move quickly to obey each order or bugle call. Each man in a smart ship only does his duty, yet he does it quickly. I hope Mr. Fullam's article may be widely circulated, for it certainly rings genuine and exploits a feature of much importance, especially as our navy is progressing in size.

Lieutenant W. S. Turpin, U. S. Navy.—Lieutenant-Commander Fullam's paper is one which should command the earnest attention of the service, for nothing is more important than good petty officers, and it must be admitted, however reluctantly, that our petty officers are not what they should be.

The author has assigned one cause for this bad state of affairs; but is there not another? I think so. This other reason seems equally, if not more, important than that assigned by the author of this very interesting paper. It is this: Are the appointments as petty officers made with the care that should be the first consideration, and are the men's qualifications sufficiently considered. As a general thing it is only necessary for a man to have a good conduct record and his appointment is assured, no matter how great a blockhead he may be in regard to general knowledge. Is a good conduct record a sufficient cause for rating a man a petty officer? Most assuredly not. That conduct should be considered cannot be denied, but if we are to obtain the best results and be able to place that very necessary reliance on our petty officers which the efficiency of the service demands, other things, such as force of character and general intelligence, must take a place and a most important one.

As the author points out, schools alone cannot make good petty officers, and can merely fill the role of preparing them for their future work on board ship.

No method can be devised to complete the work of these schools which

is better than that of allowing, in fact requiring, the petty officers to take a most important part in the drills of the ship. Many of these drills can be carried on by the petty officers alone, although the presence of an officer to supervise, and in a manner aid, the petty officers seems advisable, at least until their efficiency is somewhat increased. It has been my experience that the more responsibility that is put on the petty officer the more he will accomplish. As soon as he learns that it is not assumed that he has to be constantly watched, and that he is expected to at least know something, he will take an interest in improving himself.

The author has pointed out a method by which we can bring about this very much desired change; let us therefore get to work and stop talking.

PROFESSIONAL NOTES.

Prepared by Lieutenant E. L. BEACH, U. S. Navy.

For convenience of reference these notes are prepared as follows:

A. Notes on ships of war and on navies, the notes appearing under the head of the naval power to which they refer. Alphabetical arrangement is followed.

B. Miscellaneous notes on ammunition, ordnance, docks, etc. The arrangement is alphabetical and the principal heads are:

1. Ammunition.
2. Docks.
3. Gunpowder.
4. Liquid Fuel.
5. Ordnance.
6. Submarine Boats.
7. Wireless Telegraphy.

SHIPS OF WAR, BUDGETS AND PERSONNEL.

ARGENTINA.

The armored cruiser Rivadavia, building at Ausaldo's yard, Genoa, was launched on October 22. Until the time of her launching, this ship has been known as the "General San Mitra." She was ordered by Spain in 1897 but was sold to Argentina the following year. She is Italian in type and design, and much resembles the Francesco Ferraccio, which was described in Professional Notes of No. 102 of PROCEEDINGS. Her tonnage is about 8000. She has twin-screw engines of 14,000 horsepower, designed to produce a speed of 19 knots. She is protected by a six-inch armored belt, decreasing to 4½ inches at the ends. The barbettes, hoods, conning-tower, etc., are all protected by 6-inch armor. The battery will be one 10-inch, two 8-inch, fourteen 6-inch, two 3-inch, ten 6-pounders, eight 1-pounder guns, and four above-water torpedo tubes.

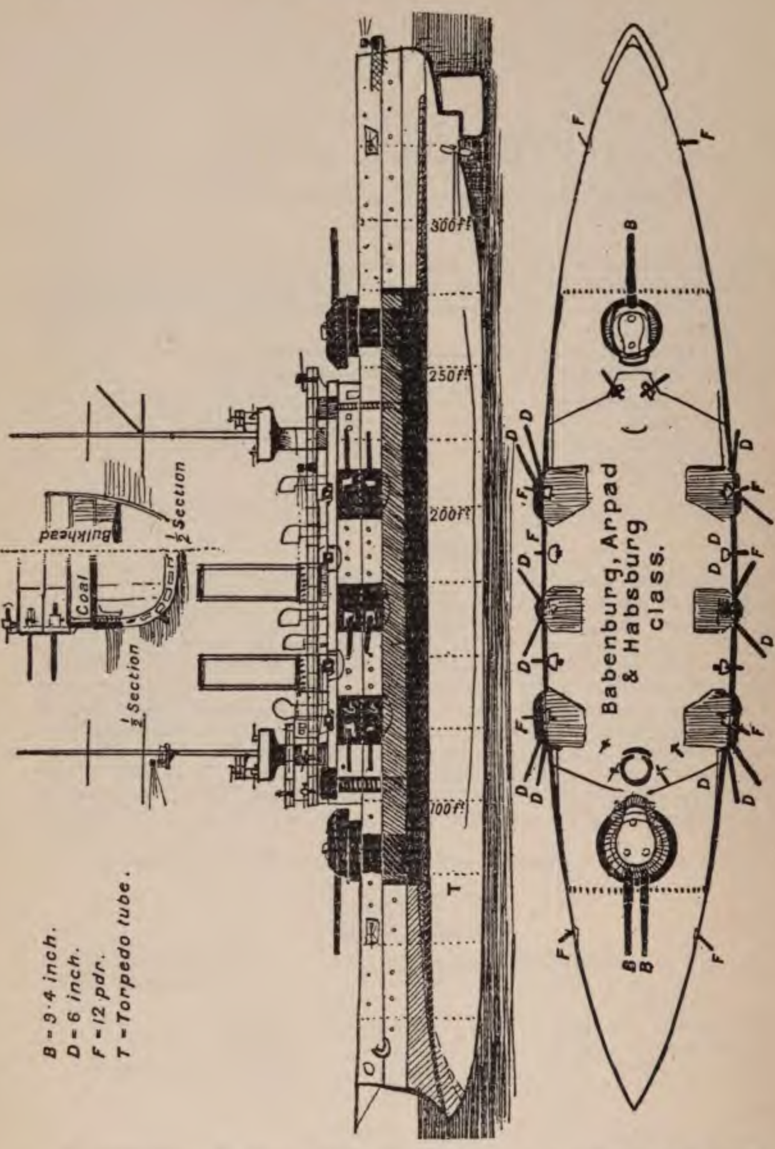
A sister ship, the General Roca, is building at the same place.

AUSTRIA.

VESSELS BUILDING.

Name.	Displacement, tons.	Where Building.	Remarks, date of completion.
BATTLESHIPS.			
A (ersatz-Loudon)	10,600	Trieste.	Building.
B (ersatz-Drache)	10,600	"	Ordered.
Babenberg	8,340	Pola.	Building; lchd. Oct., 1902.
Arpad	8,340	Trieste.	"
Hapsburg	8,340	"	"
ARMORED CRUISER.			
E (ersatz-Radetzky)	7,400	Pola.	"
PROTECTED CRUISER.			
Szigetvar	2,350	"	
RIVER MONITORS.			
I	450		
II	450		

The new battleships are to be fitted with Yarrow boilers.



AUSTRIAN BATTLESHIP BABENBURG.

BABENBERG.—This moderate-sized battleship, a sister to the Arpad and Habsburg, was launched at Pola on October 4. Her dimensions are as follows: Displacement, 8340 tons; beam, 65½ feet; draft, 23 feet. Her battery is as follows: Three 9.4-inch, twelve 6-inch, ten 12-pounders, and sixteen machine guns. She is fitted with two submerged torpedo tubes.

There are two sets of 4 cylinder, triple expansion engines, developing 11,900 horsepower, and 18.5 knots speed. The maximum coal supply is 840 tons.

Her armor is arranged as follows:

There is a main belt of 8¾-inch Krupp steel, 8 feet wide and 223 feet long amidships, topped with a 2½-inch deck, and terminated by 8-inch bulkheads, from the lower edges of which the protective deck extends fore and aft. The bow is reinforced with a 2-inch plating 8 feet high, of which, like the main belt, 3½ feet is above the water.

Above the main belt is the upper belt redoubt, also 223 feet long and 7½ feet high. It has a thickness of 4 inches only, save at the ends, where the flat bulkneads are 8 inches thick. A 1-inch steel main deck covers this redoubt. On it stand the casemates in double story 5-inch on the fronts, 3-inch at the backs. The conning-towers are 8-inch for the forward and 4-inch for the after one, with 6-inch communication tubes to each of them. The turrets stand on 7-inch circular towers, which contain all the machinery. These widen to low barbettes on the deck, the turrets revolving over them. The fore turret carries two and the after one one 9.4-inch of 40 calibres. The 6-inch guns are also of 40 calibres. The big guns are electrically controlled, and electric hoists and ventilators are fitted throughout the ship. The hoists to the 6-inch guns can supply eight rounds per minute. There are six dynamos and six searchlights. The total weight of armor is 2250 tons—roughly a quarter of the displacement. This is some 500 tons more than our Canopus, of 13,000 tons displacement, carries.

The ship can be steered from seven positions, and is to put her helm right over in thirty seconds. The boilers are of the Belleville type, instead of the Yarrow adopted for all future Austrian ships. They will work at the British pressure of 300 lbs. in the boilers reduced to 250 lbs. at the engines. This is in excess of what is usually demanded abroad.

The arcs of fire are: Big guns, 270 deg.; end casemates, 135 deg. from axial line; other casemates, 100 deg.

The broadside fire is: Three 9.4-inch, six 6-inch, five 12-pounders. End-on fire: Two 9.4-inch (astern only one 9.4-inch), four 6-inch, two 12-pounders.

HABSBURG.—This battleship has recently had its official trials off Pola; the contract required a speed of 18.5 knots, but 19.62 knots were actually made; the required horsepower was 11,900, but 15,400 was actually developed.

The description and illustration of the Babenberg apply also to the Habsburg.

FRANCE.

VESSELS BUILDING.

Name.	Displacement, tons.	Where Building.	Remarks; date of launch; probable date of completion.
BATTLESHIPS.			
Démocratie	14,865	Brest.	Ordered.
République	14,865	"	Launched Sept. 24.
Patrie	14,865	La Seyne.	Ordered.
Liberté	14,865	St. Nazaire.	"
Justice	14,865	La Seyne.	"
Verité	14,865	Bordeaux.	"
Suffren	12,728	Brest.	Launched; nearly complete.
Iéna	12,052	"	Practically completed.
Henry IV	8,948	Cherbourg.	Lchd.; practically completed.
ARMORED CRUISERS.			
Ernest Renan	12,550	Brest.	Ordered.
Jules Michelet	12,550	Lorient.	"
Jules Ferry	12,550	Cherbourg.	Not yet lchd.; complete 1904.

VESSELS BUILDING.—CONTINUED.

Name.	Displacement, tons.	Where Building.	Remarks.
Victor Hugo	12,550	Lorient.	Not yet lchd.; complete 1904.
Léon Gambetta	12,550	Brest.	Lchd. Oct. 26, 1901; compl. '04.
Jeanne d'Arc	11,270	Toulon.	Launched 1899.
Gloire	10,014	Lorient.	Launched 1900; complete 1903.
Marseillaise	10,014	Brest.	Launched 1900; complete 1902.
Amiral Aube	10,014	St. Nazaire.	Lchd. May 9, '02; compl. 1903.
Sully	10,014	La Seyne.	Lchd. June 4, '02; compl. 1903.
Condé	10,014	Lorient.	Lchd. Mar. 12, '02; compl. '03.
Amiral Gueydon	9,516	"	Lchd. '99; com. '02 under trial.
Dupetit Thouars	9,516	Toulon.	Lchd. July 5, 1901; compl. '03.
Montcalm	9,516	La Seyne.	Lchd. Mar. 28, '00; compl. '02.
Desaix	7,700	St. Nazaire.	Lchd. Mar. 21, '01; compl. '03.
Dupleix	7,700	Rochefort.	Lchd. Apr. 28, '00; compl. '03.
Kléber	7,700	Bordeaux.	Lchd. Sept., '02; compl. 1903.
PROTECTED CRUISERS.			
Jurien de la Graviere	5,500	Lorient.	Lchd. '99; com. '02 under trial.
Chateaurenault	8,018	La Seyne.	Not yet accepted; machinery unsatisfactory.
TRANSPORT.			
Vaucluse	1,650	Rochefort.	Launched; complete 1902.
TORPEDO-BOAT DESTROYERS.			
Pertuisane	303	Rochefort.	Lchd. Dec. 5, 1900; compl. '02.
Escopette	303	"	Lchd. Dec. 20, '00; compl. '02.
Flamberge	303	"	Lchd. Oct. 28, '01; compl. '03.
Rapière	303	"	Lchd. July 16, '01; compl. '02.
Sarbacane	303	"	Laid down 1901.
Carabine	303	"	Launched July 21, 1902.
Francisque	303	"	Ordered.
Sabre	303	"	"
Arquebuse	303	Havre.	Complete 1903.
Arbalète	303	"	"
Mousquet	303	"	"
Sagaie	303	"	"
Epieu	303	"	"
Harpon	303	"	"
Fronde	303	"	"
Javeline	303	"	"
Bombarde	303	"	"
Catapulte	303	"	"
Dard	303	(?) Rouen.	Ordered.
Baliste	303	(?) "	"
Mousqueton	303	Chalons.	"
Arc	303	"	"
Pistolet	303	Nantes.	Ordered.
Bélier	303	"	"
M_{22}	?	Rochefort.	"
M_{23}	?	"	"
TORPEDO BOATS.			
Rafale	162	Havre.	About completed.
255, 256, 257	906	"	" "
259, 260, 261	90	Bordeaux.	" "
262, 263	86 to 90	Chalons.	" "
264, 265	90	Bordeaux.	" "
266, 267, 268	87	?	Building.
269, 270	91	Havre.	"
272, 275	89	Chalons.	"

VESSELS BUILDING.—CONTINUED.

Name.	Displacement, tons.	Where building.	Remarks.
273, 274	91	Bordeaux.	Building.
275, 276	90	"	"
277	90	Saigon.	"
Libellule	40	Havre.	Building (turbine machinery).
SUBMARINE BOATS.			
Farfardet	185	Rochefort.	Launched; about completed.
Gnome	185	"	" " "
Korrigan	185	"	" " "
Lutin	185	"	" " "
Perle	70	Toulon.	Building.
Bonite	70	"	Building, ordered in 1901.
Esturgeon	70	"	" " "
Thon	70	"	" " "
Souffleur	70	"	" " "
Anquille	70	"	" " "
Aloze	70	"	" " "
Dorade	70	"	" " "
Truite	70	"	" " "
Girondin	70	"	" " "
Naiade	68	Cherbourg.	" " "
Protée	68	"	" " "
Lynx	68	"	" " "
Ludion	68	"	" " "
Loutre	70	Rochefort.	" " "
Castor	70	"	" " "
Phoque	70	"	" " "
Otarie	70	"	" " "
Méduse	70	"	" " "
Oursin	70	"	" " "
Q_{35}			" " "
Q_{36}			" " "
Q_{37}			" " "
17 boats		Various places.	Build'g all completed by 1904.

REPUBLIQUE.—Six vessels of this type are being built. The Republique is the first to be launched and should be completed next year.

The complement of officers and men is 822.

The guns, armor, power and dimensions are as follows:

Armament.—Four 12-inch guns in pairs in balanced turrets forward and aft. Eighteen 6.48-inch guns: twelve in pairs in turrets; six in casemates. Twenty-six 3-pounders. Two 1-pounders. Five torpedo tubes, of which two are to be submerged.

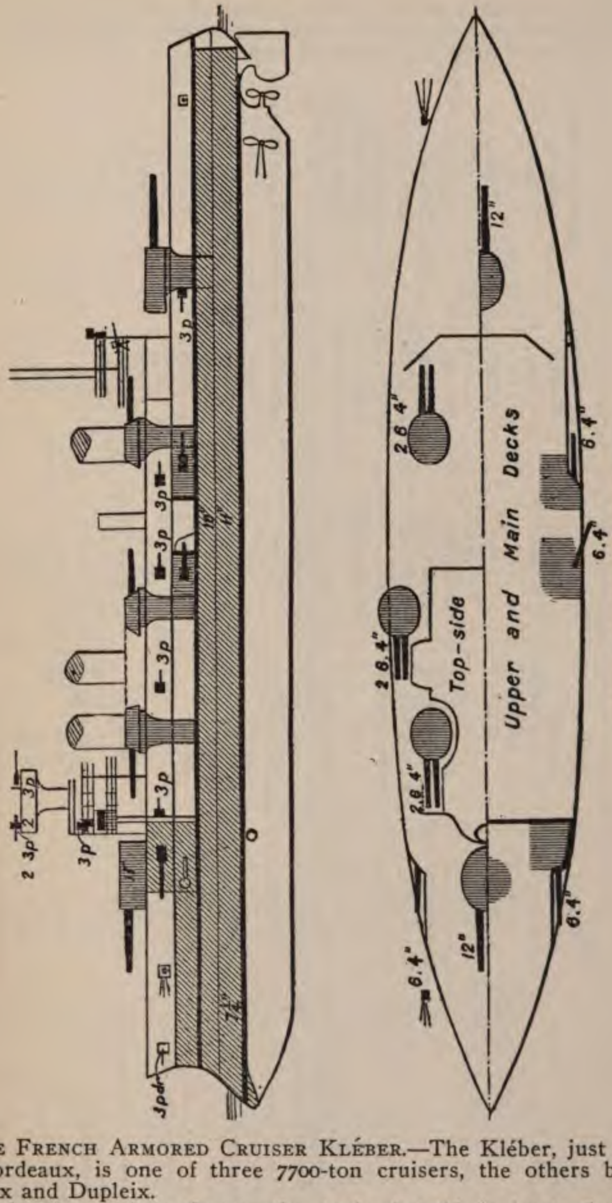
Protection.—Complete belt, 12 inches thick at the water-line amidships. Above this is a thinner belt, also complete, and 4 inches thick, rising to a height of 8.2 feet above the water at normal load. Complete protective deck 4 inches thick on the slopes. Main turrets, 11 to 12.5 inches thick.

Motive power.—Triple-screw, triple-expansion engines of 14,475 I. H. P. Designed speed, 18 knots. Normal coal supply, 905 tons; total coal capacity, 1825 tons.

Dimensions.—Length, 438.9 feet; beam, 79.5 feet; draft, aft, 27.5 feet; displacement, 14,865 tons (metric).

The London *Engineer* makes the following comparison between recent designs of battleships:

Nation	French.		British.	German.	U. S. A.	Italian.
Name	Republique.	Suffren.	King Edward.	"H. and J."	New Jersey.	Vittorio Emanuele.
Displacement	14,865	12,728	16,500	13,200	15,000	12,625
Length	439½	410	425	396	435	435
Beam	79½	70	78	73	76	73½
Draft (mean)	27½	27½	26¾	25	26	26
Big guns	Four 12-in.	Four 12-in.	Four 12-in.	Four 11-in.	Four 12-in.	Two 12-in.
	....	....	Four 9.2-in.	....	Eight 8-in.	Twelve 8-in.
Medium guns	Eighteen 6.4-in.	Ten 6.4-in.	Ten 6-in.	Fourteen 6.7-in.	Twelve 6-in.	....
	....	Eight 4-in.	....	....	....	Twelve 4-in.
Small guns	....	....	Eighteen 3-in.	Twelve 3.4-in.	Twelve 3-in.	....
	Twenty-six 3-pdr.	Twenty 3-pdr.	Six 3-pdr. C.	....	Eight 3-pdr.	Twelve 3-pdr.
	Two.	Two.	(?)	Twelve.	Sixteen.	(?)
Torpedo tubes—						
Submerged	Two.	Two.	Four.	Five.	Two (?)	Four.
Above-water	Three.	Two.	....	One.	....	....
I. H. P.	17,475	16,200	18,000	16,000	19,000	20,000
Speed, knots	18	18	18.5	18	19	22
Screws	Three.	Three.	Two.	Three.	Two.	Two.
Coal, normal	905	820	1,000	700	900	1000
Coal, maximum	1825	1150	2,000	900	1900	2800
Plus	Oil.	Oil.	....	Oil.	....	Oil.



FRENCH BATTLESHIP REPUBLIQUE.

THE FRENCH ARMORED CRUISER KLÉBER.—The Kléber, just launched at Bordeaux, is one of three 7700-ton cruisers, the others being the Desaix and Dupleix.

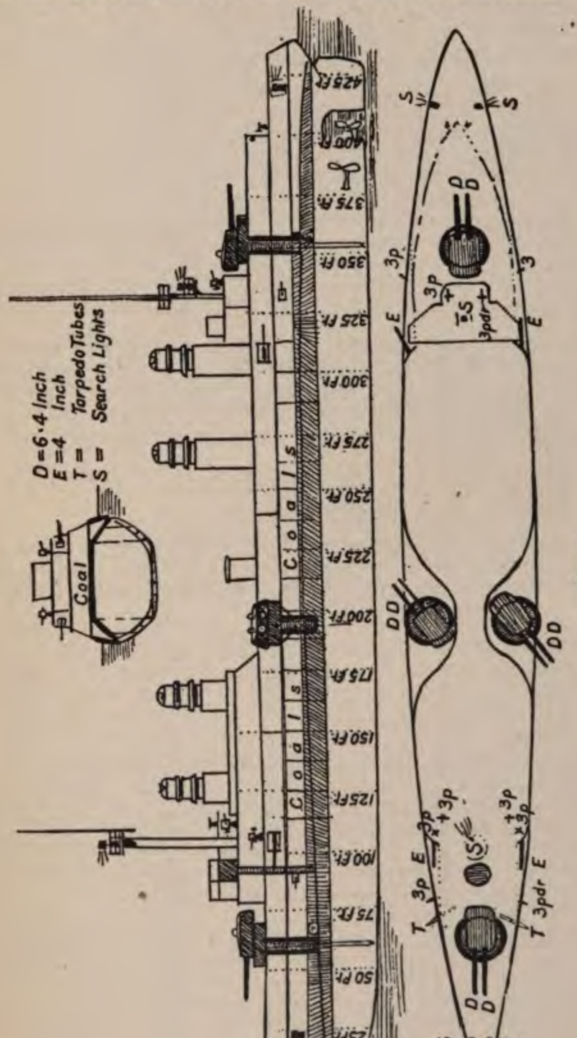
She has been a long time on the stocks, but this is due to the fact that she has been practically completed before being set afloat. That is to say guns, armor, machinery, and boilers were all on board when she was floated.

The ship is of special interest in that she represents an entirely novel

type. It is one little loved in France, where she has been severely criticised as too weak for modern war. How she compares with other ships will be seen from the following table:

Nationality	French.	Russian.	Austrian.	Chilian.	Italian.
Name	Kléber.	Bayan.	"E."	Esmeralda.	Garibaldi class.
Where built	France.	France.	Austria.	Elswick.	Ansaldo.
Displacement, tons	7700	7800	7400	7000	7400
Length	426½	443	384	436	344
Beam	58½	55¾	62	53	59
Draft (mean)	24¼	22	21½	20¼	23
Guns	Eight 6.4-in.	Two 8-in.	Two 9.4-in.	Two 8-in.	One 10-in.
	Four 4-in.	Eight 6-in.	Five 7.6-in.	Sixteen 6-in.	Two 8-in.
	Ten 3-pdrs.	Twenty 3-in.	Four 6-in.	Eight 3-in.	Fourteen 6-in.
	Six 1-pdrs.	Seven small.	Eight 2.7-in.	Nine 6-pdrs.	Two 3-in.
	....	....	Fifteen small.	Two 3-pdrs.	Ten 6-pdrs.
	....	....	....	Eight Maxims.	Eight 1-pdrs.
Torpedo tubes (submerged)	None.	2	2	2	None.
Torpedo tubes (above water)	2	3	None.	1	4
Boilers	Niclausse.	Belleville.	Yarrow.	Cylindrical.	Belleville and Niclausse.
Indicated horsepower	17,100	17,000	12,300	16,000	13,500
Extreme speed, knots	21	21	21	22.25	20
Screws	3	2	2	....	2
Armour belt	4—2-in.	8—4-in.	2—6½-in.	6-in.	4½—6-in.
Proportion of belt length	Complete.	⅘	¾	¾	Complete.
Armor, lower deck side	None.	3-in.	8¼-in.	None.	6-in.
Armor, deck	2¾-in.	2-in.	1½-in. and 3½-in.	2-in.	Thin.
On heavy guns	....	7-in.	8-in.	Nil.	6-in.
On heavy guns (bases)	....	7-in. tubes.	5-in.	4½-in.	6-in.
On secondary guns	4-in.	8-in.	5-in.	Nil.	6-in.
On secondary guns (bases)	4-in.	3-in.	8¼-in.	Nil.	6-in.
Coal (normal), tons	880	750	820	550	650
Coal (maximum), tons	1200 and oil.	1100 and oil.	Uncertain.	1350	1200 and oil.

In this list the Kléber certainly does not look well. The 6.4-inch is only a 100-pounder, and therefore better than the 6-inch only in penetration. The difference in this is scarcely worth consideration.



KLÉBER.

If we commute the broadsides to the value of 12-pounders (6-inch = 4, 8-inch = 6, 10-inch or 9.4 = 8) the ships we have compared stand as follows:

1. Esmeralda .... = 59
2. Garibaldi .... = 50
3. " E " .... = 46
4. Bayan .... = 38
5. Kléber .... = 31

Nor in armor protection is she much better; the relative merits being:

1. Garibaldi.
2. " E."
3. Bayan.
4. Kléber.
5. Esmeralda.

In speed the ships stand:

1. Esmeralda ....22.25 (23 on trial)
2. Kléber 21
3. Bayan 21
4. " E " 21
5. Garibaldi 20

As the Garibaldi takes 13,500 I. H. P. to do a knot less than the 12,300 estimated for the Austrian, this vessel, though of better speed lines, is hardly likely to be much swifter. In the Garibaldi "handiness" has been aimed at. The relative merits in this direction are:

1. Garibaldi.
2. " E."
3. Esmeralda.
4. Kléber.
5. Bayan.

In coal supply. a vital thing for cruisers, the relative order with full bunkers is approximately very equal, and so need not be assessed. Taking the other figures, we find the order of general value works out as follows:

		TONS.
1.	Esmeralda	7000
2.	Garibaldi	7400
3.	" E "	7400
4.	Kléber	7700
5.	Bayan	7800

It is certainly curious that the ships should thus work out in inverse order to displacement. It is, of course, an arbitrary placing, and must not be taken as meaning too much. Still, saving that the Bayan would find favor before the Kléber, this order is that in which probably the bulk of naval officers would select the ships for war use. Of course, by what one reads, the Esmeralda, with her unprotected guns, would be nowhere in the place for favor, but the drift of modern naval ideas tends to put her just where this list brings her.

Let us imagine her engaged against the Kléber. To begin with, she has cylindrical boilers, which, in the present stage of water tubes, is a probable advantage. Other things apart, the cylindrical boiler is easier to stoke, for it needs less skill. Skilful stokers are certain to be short in all navies in war time, and, skilful or not, stokers will weary. Deck hands can work the "tanks" well enough, but not water tubes. Therefore, "tanks" have a war value peculiarly their own. Still, as the Esmeralda probably carries cylindrical only because water tubes had hardly "come in" when she was built, we may well pass to the next point in her favor. She has speed. In a word, she can fight the Kléber or not as she pleases. Suppose her to so please, her battery is so overwhelmingly more powerful that the Kléber might never get in a reply, and that applies to most of the other ships in the comparison.

It is not, indeed, easy to see the Kléber's use. Her belt is a good substitute for a protective deck, but if ships had only water line hits to fear, they would be in little danger in battle. She lacks the protection of the Garibaldi and "E," and, sound as her system of gun mounting may be, the rest of her would soon be a wreck. Presumably she is, like our Diadems, merely an "ordinary cruiser" of an inferior type, too weakly gunned to be dangerous.

Not, however, that the design is bad so far as the placing of the guns goes. Badly as, in our experience, twin guns seem to work, there is a deal to be said for a non-distributed armament. The six broadside 6.4-inch will certainly take longer to disable as they are than if they were all distributed. Our objection is that they are too few, seeing how little armor there is, for they cannot afford that best of protection, a beating down fire. We dislike, also, the 4-inch pieces, which seem to us to multiply calibres to no purpose, the more so as the 7.6-inch usually carried in French cruisers is dispensed with in the Kléber for the sake of simplicity in armament. Twelve 5.5-inch would have been an infinitely better battery than the eight 6.4-inch and four 4-inch actually carried.

It is worth noting, by the way, that the amidship guns of the Kléber are not placed to give an end-on fire. Very likely such a fire would have had a paper value only. Still, their position is anything but ideal, for, wrecked by shell fire, the superstructure in which they rest is likely to jam these amidship turrets very early in the action.—*Engineer*, London.

GERMANY.

VESSELS BUILDING.

Name.	Displacement, tons.	Where Building.	Remarks.
BATTLESHIPS.			
Wittelsbach	11,900	Wilhelmshavn.	Completed. To be tried in October, 1902.
Wettin	11,900	Dantzic.	
Zähringen	11,900	Kiel.	Lchd. June 12, '01; compl. '03.
Mecklenburg	11,900	Stettin.	Lchd. Nov. 9, '01; compl. '03.
Schwaben	11,900	Wilhelmshavn.	Lchd. Aug. 19, '01; compl. '03.
H	13,000	Kiel.	Laid down 1901.
I	13,000	Dantzic.	Laid down 1901.
K	13,000	Stettin.	Ordered to be compl. by 1906.
L	13,000	Kiel.	Ordered to be compl. by 1906.
Kaiser Karl der Grosse	11,130	Hamburg.	Lchd. 1899; practically compl.
Kaiser Barbarossa	11,130	Dantzic.	Nearly complete.
ARMORED CRUISERS.			
Prinz Heinrich	8,868	Kiel.	Nearly complete; ready for trials.
Prinz Adalbert	9,000	"	Launched 1901; compl. 1903.
Ersatz König Wilhelm	9,000	Hamburg.	Launched June 21, 1902.
Ersatz Kaiser	9,000	Kiel.	Building.
PROTECTED CRUISERS.			
Thetis	2,645	Dantzic.	Practically complete.
Ariadne	2,645	Bremen.	" "
Amazone	2,645	Kiel.	" "
Medusa	2,645	Bremen.	" "
G (Frauenlob)	2,645	"	Launched March 22, 1902.
H	2,715	"	Launched April 22, 1902.
I	2,645	"	Ordered.
K	2,715		Not yet ordered.
L	2,715		" "
Ersatz Zieter	2,715		" "

VESSELS BUILDING.—CONTINUED.

Name.	Displacement, tons.	Where Building.	Remarks.
GUNBOATS.			
Panther	899	Dantzic.	Lchd. Apr. 1, 1901; compl. '02.
B	900	Stettin.	Ordered.
River gunboats	170	Hamburg.	Completed.
TORPEDO BOATS.			
S 102 to S 107 (6 boats).		Dantzic.	All lchd.; about completed.
G 108 to G 113 (6 boats).		Kiel.	All launched; complete 1903.
S 114 to S 119 (6 boats).	350	Dantzic.	Nearly completed.

GREAT BRITAIN.

VESSELS BUILDING.

Name.	Displacement, tons.	Where Building.	Remarks.
BATTLESHIPS.			
Hindustan	18,000	Clydebank.	Ordered.
New Zealand	18,000	Portsmouth.	"
Commonwealth	16,500	Jarrow.	Building.
Dominion	16,500	London.	"
King Edward III	16,500	Devonport.	"
Queen	15,000	"	Launched March 8, 1902.
Prince of Wales	15,000	Chatham.	Launched March 25, 1902.
ARMORED CRUISERS.			
Natal	?	Not yet ordered.	Designs ready.
Newfoundland	?	Not yet ordered.	" "
Hampshire	10,200	Elswick.	Building, not yet launched.
Devonshire	10,200	Chatham.	"
Roxburgh	10,200	Glasgow.	"
Antrim	10,200	Greenock.	"
Argyll	10,200	Clydebank.	"
Carnarvon	10,200	Glasgow.	"
Essex	9,800	Pembroke.	Nearly completed.
Kent	9,800	Portsmouth.	" "
Monmouth	9,800	Glasgow.	" "
Bedford	9,800	Govan.	" "
Cornwall	9,800	Pembroke.	" "
Suffolk	9,800	Portsmouth.	" "
Berwick	9,800	Glasgow.	" "
Cumberland	9,800	"	" "
Lancaster	9,800	Elswick.	" "
Donegal	9,800	Govan.	" "
PROTECTED CRUISERS.			
Challenger	5,880	Chatham.	Nearly completed.
Encounter	5,880	Devonport.	" "
Topay	3,000	Glasgow.	Building.
Amethyst	3,000	"	"
GUNBOATS.			
Cadmus	1,096	Sheerness.	Building.
Clio	1,096	"	"
SCOUTS. 25½ Knots, 17,000 I. H. P., 360 Feet Long.			
1	3,000	Barrow in Furness.	Ordered.
2	3,000	Elswick.	"
3	3,000	Birkenhead.	"
4	3,000	Glasgow.	"

VESSELS BUILDING.—CONTINUED.

Name.	Displacement, tons.	Where Building.	Remarks.
TORPEDO-BOAT DESTROYERS.			
Derwent		Newcastle-on-Tyne.	The displacement of these 19 destroyers will be about 400 tons. The guaranteed sea speed is 25½ knots, but this speed is to be maintained in moderate speeds.
Eden		"	
Erne		Jarrow.	
Exe		"	
Ettrick		"	
Foyle		Birkenhead.	
Itchen		"	
Ribble		London (by Yarrow).	
Teviot		" "	
Usk		" "	
Cherwell		Jarrow.	
Dee		"	
Welland		London (by Yarrow).	
Arun		Birkenhead.	
Blackwater		"	
Waverney		Newcastle-on-Tyne.	
Kennet		Chiswick.	
Jed		"	
Velox		Newcastle-on-Tyne.	
TORPEDO BOATS.			
1	180	Chiswick.	Nearly completed.
2	180	"	" "
3	180	"	" "
4	180	"	" "
5	180	"	" "
6	180	Cowes.	Building.
7	180	"	"
8	180	"	"
9	180	"	"
SUBMARINE BOATS.			
1		Barrow.	The six submarines previously built have been completed and have had their trials.
2		"	
3		"	

Battleships Building.—The above list contains the names of 7 battleships, of from 15,000 to 18,000 tons as building; nine battleships have already had or are ready for their official trials and must be considered as completed. Of these nine the folowing six, Albemarle, Cornwallis, Duncan, Exmouth, Montague, and Russell, are of 14,000 tons, and the remaining three, Bulwark, Venerable, and London, are of 15,000 tons.

Of the remaining seven battleships, two, the Queen and The Prince of Wales, of 15,000 tons, have been launched and are rapidly approaching completion. This leaves but three battleships on the stocks, the Commonwealth, Dominion, and King Edward III, of 16,500 tons. Work on these ships is proceeding with great celerity; it is expected that they will be completed early in 1904.

Two battleships, to be called the Hindustan and the New Zealand, which are to displace 18,000 tons each, have been ordered at Clydebank and Portsmouth respectively.

Armored Cruisers.—The Drake, King Alfred, Leviathan, and Good Hope, of 14,100 tons displacement, have all had their trials and must be considered as completed.

The Hampshire, Devonshire, Roxburgh, Antrim, Argyll and Carnarvon, of 10,200 tons, are the only armored cruisers building that have not yet been launched.

The Essex, Kent, Monmouth, Bedford, Cornwall, Suffolk, Berwick, Cumberland, Lancaster, Donegal, of 9800 tons, have all been launched, and all are rapidly approaching completion.

The Hague, Sutlej, Euryalus, and Bacchante, of 12,000 tons, have all had their trials and are practically complete.

Protected Cruisers.—The Challenger and Encounter, of 5880 tons, are nearly completed. The Topay and Amethyst, of 3000 tons, will be completed in 1903.

Struck from List.—The following ships have been condemned and have been ordered to be sold: Ajax, Inflexible, Neptune, Hydra, Glatton, battleships; Melita, sloop.

Donegal, Launched September 4.—No other vessel has been so far advanced in construction and equipment when launched, and everything points to her being delivered in record time. Her length between perpendiculars is 440 feet; breadth moulded, 66 feet 2 inches; displacement, 9800 tons; the indicated horsepower of her engines, 22,000; and her contract speed, 23 knots. In addition to a main protective deck, which extends from the stem to the 3-inch armor bulkhead—or practically the full length of ship—and ranges in thickness from ¾-inch to 2-inch, there is a belt of specially hardened steel of three thicknesses, 4½-inch, 3-inch and 2-inch—the 4½-inch extending from the armor bulkhead for about 240 feet forward of it, the 3-inch for about 40 feet, and the 2-inch, which is nickel steel, from that point to the stem. The main protective deck is worked at the lower edge of this armor, and protects the vitals of the ship, while another protective deck, 1-inch to 1¼-inch thick, forms a crown over the side armor and armor bulkhead, etc. The armor has been supplied by Cammell and Company, Limited, Sheffield. The vessel is, as usual, extensively subdivided into numerous water-tight compartments. The coal bunkers range along the sides of the machinery compartments, both below and above the lower deck, and are provided with the usual fittings for rapidly handling and distributing the coals. The vessel's normal capacity is about 800 tons, but this can be doubled, if necessary, ample space being allotted for this essential requirement.

The armament consists of two 6-inch guns in barbettes, one forward and one aft, enclosed in gun-houses with specially armored inclined shields. The guns are served through armored trunks from the magazines and shell rooms. The barbette walls are 4 inches thick, and well supported by the general structure. Four 6-inch guns in casemates on the upper deck, and four 6-inch guns in casemates on the main deck forward and aft, together with the twin guns, give fore-and-aft fire at a high range. Two 6-inch guns in midship casemates on main deck secure a heavy broadside fire. The fronts of the casemates are 4 inches thick of hard steel, with the rear plates 2 inches in thickness. Eight 12-pounder 12 cwt. guns and two 12-pounder 8 cwt. field and boat guns are distributed at suitable positions, with an auxiliary armament of three 3-pounder and eight Maxim guns. At the fore end of the vessel is provided a steel conning-tower of 10 inches in thickness, with a communicating tube to protect the gear for controlling operations throughout the ship. A navigating bridge with the usual appliances is fitted forward. The complement of the ship is 700 officers and men, for whose accommodation the most ample provision has been made. Electricity is installed throughout the vessel on the double-wired system, while six powerful searchlights are fitted—two on the forward bridge, two on the shelter deck aft, and one

on each mast on a platform of great elevation. The vessel will have three funnels and two masts.

The propelling machinery consists of two sets of triple-expansion engines, which are to develop on trial 22,000 indicated horsepower, and are fitted in two water-tight compartments, each set having four inverted cylinders working on four cranks. The high-pressure cylinders are 37-inch diameter, intermediate 60-inch, and low-pressure cylinders 69-inch diameter, all adapted for a stroke of 3 feet 6 inches. Of these engines we hope to give fuller details, with illustrations, in a later issue. Steam will be supplied by an installation of thirty-one water-tube boilers and economizers, all of the latest Belleville type, designed to work at a pressure of 300 lbs., the boilers being arranged in three groups, each in a water-tight compartment. Air pumping engines will be fitted in each boiler-room to supply air to the furnaces and combustion chambers, and the necessary air for the stokehold ventilation will be supplied by large fans. Fans will also be fitted for the engine-room and ship ventilation. The launch was timed for half-past one o'clock, and almost to the minute the big vessel was released and named by the Duchess of Abercorn. The launch was thoroughly successful, and after being floated the new vessel was taken into the builders' fitting-out basin, where she will be engined and completed.—*Engineer*, London.

THE NEW 25-KNOT "SCOUTS" FOR THE BRITISH NAVY.—The new "scouts," of which four have been ordered for the British Navy, are to be about 360 feet in length, with a displacement somewhat under 3000 tons. They are not intended to be improvements on the "destroyer" class, but have a separate and distinct function, being primarily intended for use as the eyes of the fleet which they accompany. At the same time they are sufficiently armed to put any "destroyer" which crosses their path *hors de combat*. The comparative great length of these vessels, when combined with the long forecastle, will make them excellent sea-boats, whilst the machinery being very much more strongly built than in the "destroyer" type, will enable them to keep up the guaranteed speed of 25 knots in any ordinary sea. The scantlings of the hull have been arranged to bear far greater strains than could possibly exist in any sea likely to be encountered, and there is a complete protective deck, carried from end to end, and sloped to below the water-line all fore-and-aft; this deck varies in thickness from ⅝ inch to 1½ inches. The coal carried in the normal condition is 165 tons, the full supply being about 380 tons, which, at a speed of 10 to 12 knots, will give a radius of action of about 3000 miles. The boilers are of the small-tube "Express" type. The armament includes six 12-pounder quick-firing guns—two forward on the forecastle, two aft, and two amidships on the upper deck; eight 3-pounder quick-firing guns, four on each broadside on the upper deck; two 18-inch above-water torpedo tubes fitted on the upper deck, and training one on each broadside. Taken altogether, these vessels seem admirably adapted to the service intended, and in addition to acting as scouts, will minimize to a very large extent the danger to a fleet from a flotilla of hostile destroyers.—*Engineering*, London.

CRUISER DESIGN.—We have time and again urged the importance of augmenting the gun power of our cruisers, in view especially of the increasing resistance of modern armor, and all who have studied the subject will be glad to note that Mr. Philip Watts, the new Director of Naval Construction, has signalized his accession to office by making a radical departure in the design of first-class cruisers, which confers, among other advantages, an important addition to the power, as well as calibre, of the primary armament. The new ships, which are to be known as the Duke of Edinburgh class, are to have citadels, as distinct

nized by many Powers that gun power is a most important factor, and we note that at the present time a controversy is in progress in the United States Designing Department over this same question, the constructive and executive officers strongly urging that the new cruisers should only be of 22 knots, so as to secure the gun power for these ships which we have already indicated, while the engineering branch strongly advocate the importance of high speed even at increased size and cost, the aim being to build ships to equal the 23½ knots of our Drake class.

FIRE OF PRIMARY ARMAMENT PER MINUTE.

Duke of Edinburgh (13,500 tons)	24 at 380 lb.	= 9,120 lb. and	441,600 foot-tons.
	80 " 100 "	= 8,000 "	387,200 "
	104	17,120 "	828,800 "
Drake (14,000 tons)	8 " 380 "	= 3,040 "	147,200 "
	128 " 100 "	= 12,800 "	619,520 "
	136	15,840 "	766,720 "
Devonshire (10,400 tons)	10 " 200 "	= 2,000 "	101,200 "
	80 " 100 "	= 8,000 "	387,200 "
	90	10,000	488,400
Kent (9,800 tons)	112 " 100 "	= 11,200 "	542,080 "

—*Engineering*, London.

ITALY.

VESSELS BUILDING.

Name.	Displacement, tons.	Where Building.	Remarks.
BATTLESHIPS.			
A	12,625	Gov't Yard, Spezia.	Building.
B	12,625	Gov't Yard, Castellamare.	"
C	12,625	Gov't Yard, Castellamare.	Ordered.
Vittorio Emanuela	12,625	Gov't Yard, Spezia.	Not yet launched.
Regina Elena	12,625	Gov't Yard, Castellamare.	Not yet launched.
Benedetto Brin	13,526	Gov't Yard, Castellamare.	Launched Nov. 7, 1901.
Regina Margherita	13,526	Gov't Yard, Spezia.	Launched May 30, 1901.
ARMORED CRUISER.			
Francesco Ferruccio	7,400	Gov't Yard, Venice.	Launched Apr. 30, 1902.
TORPEDO CRUISER.			
Coatit	1,318	Gov't Yard, Castellamare.	Nearly completed.
TORPEDO-BOAT DESTROYERS.			
Aquilone	360	C. T. T. Pattison, Naples.	Launched Oct. 16, 1902.
Borea	360	" " "	Not yet launched.
Meteoro	360	" " "	" " "
Tuono	360	" " "	" " "
TORPEDO BOATS.			
X			Not yet ordered.
X			" " "
X			" " "
X			" " "
SUBMARINE BOATS.			
		Gov't Yard, Spezia (?).	Building.
AUXILIARY SHIPS.			
Collier			"
Collier			"
Supply Ship			Not yet ordered.

JAPAN.

VESSELS BUILDING.

Name.	Displacement, tons.	Where Building.	Remarks.
BATTLESHIPS.			
1, 2, 3, 4	15,000		Proposed, not ordered.
ARMORED CRUISER.			
1, 2	9,900		" " "
PROTECTED CRUISERS.			
3, 4, 5, 6	5,500		" " "
A (?)		Clydebank (?)	Details of design not given.
B (?)		Clydebank (?)	" " "
Niitaka	3,365	Yokosuka.	Building.
Tsushima	3,365	"	"
TORPEDO-BOAT DESTROYERS.			
Asashio	333	Thornycroft, England.	Nearing completion.
Asagiro	375	Gov't Yard, Yokosuka.	Not yet launched.
Harusame	375	" " "	" " "
Hayatori	375	" " "	" " "
Murasame	375	" " "	" " "
X			Turbine boat; projected.
X			" " "
X			" " "
TORPEDO BOATS.			
Awataki	150	Gov't Yard, Kure.	Not yet launched.
Hato	150	" " "	" " "
Hibari	150	" " "	" " "
Kari	150	" " "	" " "
Kiji	150	" " "	" " "
Tsubame	150	" " "	" " "
Hashitaka	120	Kawasaki Works, Kobe.	Ordered.
Otori	120	" " "	"
Kamone	120	Gov't Yard, Kure.	"
Sagi	120	" " "	"
Uzuri	120	" " "	"
57, 58, 59	80	" " "	Nearing completion.
60, 61	83	Kobe; built at Elbing in sections.	Probably finished.
62, 63, 64, 65, 66	83	Sasebo; built at Poplar in sections.	" "
3 boats	88	Gov't Yard, Sasebo.	" "
2 boats	88	Gov't Yard, Yokosuka.	Ordered.

Recent press reports state that Japan's new naval construction policy contemplates the building of four battleships. two armored and four protected cruisers, and fifteen destroyers and fifty torpedo boats in the next six years.

The battleships are to be built in England, the cruisers in England, France, and Germany, and the smaller craft in Japan. The total tonnage of this program is 120,000, and the total cost is to be $60,000,000.

NETHERLANDS.

VESSELS BUILDING.

Name.	Displacement, tons.	Where Building.	Remarks.
ARMORED CRUISERS.			
Hertog Hendrik	4,950	Amsterdam.	Lchd. 1901.
A 4	4,950		Projected.
A 5	4,950		"

NORWAY.

VESSELS BUILDING.

Name.	Displacement, tons.	Where Building.	Remarks.
ARMORED CRUISER.			
A	8,847	Elswick.	Sister ship to Eidsvold.

PORTUGAL.

The Portuguese ironclad Vasco da Gama has completed the first stage of her reconstruction.

RUSSIA.

VESSELS BUILDING.

Name.	Displacement, tons.	Where Building.	Remarks.
BATTLESHIPS.			
X	12,000	....	Projected.
X	12,000	....	"
X	12,000	....	"
X	12,000	....	"
X	12,000	....	"
Slava	13,516	St. Petersburg.	Not yet launched.
Orel	13,516	"	Launched July 19, 1902.
Kniaz Suvaroy	13,516	"	Not yet launched.
Borodino	13,516	"	Launched September 8, 1901.
Imperator Alexander III	13,516	"	Launched August 3, 1901.
Tsarevitch	12,900	La Seyne, France.	Launched February 23, 1901.
Kniaz Potemkin Tavrichesky	12,585	Nicolaiev, Russia.	Launched Oct. 9, 1900. Compl.
X	12,585	" "	Not yet launched.
CRUISERS.			
Admiral Boutakov	5,000	St. Petersburg.	Not yet launched.
X	5,000	....	Projected.
X	6,000	St. Petersburg.	"
X	6,000	"	"
Bayan	7,800	La Seyne, France.	Lched. June 12, 1901; under trial; nearly completed.
Oleg	6,600	St. Petersburg.	Building.
Kagul	6,250	Nicolaiev, Russia.	Launched in October.
Otshakov	6,250	Lazarev, Russia.	Launched Oct. 4, 1902.
X	6,375	Libau, Russia.	....
Vitiaz	6,375	St. Petersburg.	Destroyed by fire June 13, '01.
X	6,375	"	Injured by fire June 13, 1901.
Aurora	6,630	"	Completed.
Pallada	6,630	....	Completed. Under trial.
Diana	6,630	St. Petersburg.	Completed. Under trial.
X		Schichau, Dantzic.	Not yet launched.
Boyarin	3,000	Copenhagen.	Launched June 8, 901. Under trial; nearly complete.
Kalgouia	3,200	Nicolaiev.	Not yet launched.
Almaz	3,200	St. Petersburg.	Not yet launched.
Jemtchug	3,200	"	Building.
Izumrud	3,200	"	Building.
MISCELLANEOUS.			
Kamchatka (troop ship)	7,200	"	Launched October, 1902.
Imperial Yacht	(?)	(?)	No recent information.
Okean	12,000	Kiel.	Launched February 8, 1902.

VESSELS BUILDING.—CONTINUED.

Name.	Displacement, tons.	Where Building.	Remarks.
TORPEDO-BOAT DESTROYERS.			
Baklan	350	St. Petersburg.	Launched August 12, 1901.
Bekass	350	"	Building.
Gorlitsa	350	"	"
Kulik	350	"	"
Perepel	350	"	"
Skvorets	350	"	"
Strij	350	"	"
Chtchegol	350	"	"
Albatross	350	"	"
Drozd	350	"	"
Diatel	350	"	"
Bezuprechin	350	"	Launched.
Givoi	350	Nicolaiev.	Ordered.
Givuca	350	"	"
Giutky	350	"	"
Giarky	350	"	"
Zavidni	350	"	"
Zavetni	350	"	"
Osiotr	312	Havre.	Building.
Kefal	312	"	Launched November 28, 1901.
Filin	240	Ijora Works, Russia.	Practically complete.
Gagara	240	" " "	" "
Krecet	240	" " "	Building.
Korsum	240	" " "	"
Sowa	240	" " "	Practically complete.
Voron	240	" " "	" "
Berkut	250	" " "	" "
Nyrok	250	" " "	" "
Yastreb	250	" " "	" "
TORPEDO BOATS.			
Akoula	150	St. Petersburg.	Launched August 24, 1901.
Bytchek	150	"	" " "
Keta	150	"	Building.
Makrel	150	"	"
Nalim	150	"	"
Okun	150	"	"
Paltus	150	"	"
Pescar	150	"	"
Plotva	150	"	"
Sig	150	"	"
X	150	"	Ordered.
X	150	"	"
X	150	"	"
X	150	"	"
X	150	"	"
Ice Breaking Boat	(?)	Helsingfors.	Building.
SUBMARINE BOATS.			
(Kuteinikov type)	20	Kronstadt.	Ready for trial.
2d Submarine Boat	(?)	"	Ordered.

SPAIN.

VESSELS BUILDING.

Name.	Displacement, tons.	Where Building.	Remarks.
ARMORED CRUISER.			
Reina Regente	5,372	Ferrol.	
PROTECTED CRUISER.			
Isabel la Catolica	3,500	Canaca.	

BUILDING PROGRAM.—Spain has determined upon a pretentious building program of battleships and armored cruisers, but the details of this program have not been definitely decided upon.

SWEDEN.

VESSELS BUILDING.

Name.	Displacement, tons.	Where Building.	Remarks.
COAST-DEFENSE VESSEL.			
Manligheten	3,670	Malwö.	Sister to Aeron.

TURKEY.

The details of the reconstruction of vessels of the Turkish navy have been given in the Professional Notes of preceding numbers.

Press reports state that instead of building two battleships, as had been ordered, the Turkish government will purchase from the Argentine government the armored cruisers General Roca and the Rivadavia, which have been undergoing construction in Ansaldo's yard at Genoa for the Argentine government.

UNITED STATES.

VESSELS BUILDING (September 1, 1902).

GIVING PER CENT COMPLETED OF TOTAL WORK REQUIRED TO BUILD THEM.

BATTLESHIPS.

No.	Name (displacement)	Per cent completed	No.	Name (displacement)	Per cent completed
10	Maine (12,000 tons)	98	15	Georgia (15,000)	16
11	Missouri (12,500)	79	16	New Jersey (15,000)	21
12	Ohio (12,500)	67	17	Rhode Island (14,600)	21
13	Virginia (14,600)	11	18	Connecticut (17,000)	1
14	Nebraska (15,000)	12	19	Louisiana (17,000)	0

ARMORED CRUISERS.

No.	Name (displacement)	Per cent completed	No.	Name (displacement)	Per cent completed
4	Pennsylvania (14,000 tons)	38	8	Maryland (13,600 tons)	39
5	West Virginia (14,000)	41	9	South Dakota (13,600)	14
6	California (14,000)	15	10	Tennessee (14,500)	0
7	Colorado (13,600)	41	11	Washington (14,500)	0

PROTECTED CRUISERS.

No.	Name (displacement)	Per cent completed	No.	Name (displacement)	Per cent completed
14	Denver (3,100 tons)	85	19	Cleveland (3,100 tons)	90
15	Des Moines (3,100)	77	20	St. Louis (9,600)	11
16	Chattanooga (3,100)	68	21	Milwaukee (9,600)	6
17	Galveston (3,100)	66	22	Charleston (9,600)	20
18	Tacoma (3,100)	57			

VESSELS BUILDING (September 1, 1902).—CONTINUED.

MONITORS.

No.	Name (displacement)	Per cent completed	No.	Name (displacement)	Per cent completed
8	Nevada (3,214)	99	9	Florida (3,214)	95

GUNBOATS.

No.	Name (displacement)	Per cent completed	No.	Name (displacement)	Per cent completed
	Paducah (1,050 tons)	0		Dubuque (1,050 tons)	0

TORPEDO-BOAT DESTROYERS.

No.	Name (displacement)	Per cent completed	No.	Name (displacement)	Per cent completed
6	Hopkins (408)	95	8	Lawrence (400)	99
7	Hull (408)	96	9	McDonough (400)	99

TORPEDO BOATS.

No.	Name (displacement)	Per cent completed	No.	Name (displacement)	Per cent completed
19	Stringham (340 tons)	98	29	Nicholson (174 tons)	98
20	Goldsborough (247.5)	99	30	O'Brien (174)	98
27	Blakely (165)	99	34	Tingey (165)	74

SUBMARINE TORPEDO BOATS.

No.	Name (displacement)	Per cent completed	No.	Name (displacement)	Per cent completed
1	Plunger (120 tons)	99	7	Porpoise (120 tons)	99
4	Grampus (120)	90	8	Shark (120)	98
6	Pike (120)	82			

ARMORED CRUISERS TENNESSEE AND WASHINGTON.—There are probably no vessels in the United States Navy, the general features or details of whose designs have been given such careful consideration as the two battleships and the two armored cruisers, authorized by Act of Congress of July 1, 1902. The designs of the two battleships have been completed, the contract for one, the Louisiana, having been awarded to the Newport News Shipbuilding and Dry Dock Company, the other, the Connecticut, is building at the New York Navy Yard. Both of the armored cruisers, the Tennessee and Washington, are to be built by contract. Speed is to be 22 knots, one knot in excess of the New York and Brooklyn. The Tennessee and Washington excel in battery power and protection any armored cruiser built, building, or designed, in the world, and they are the equal of a large majority of the battleships of the world, bearing the same relation to the battleship as the cavalry does to the infantry in the army, and being able to give battle or run away from the enemy's battleship, as they please, and to put up a stiff fight with the finest battleships afloat, with a fair chance of winning out. The battery power has been greatly increased, by the substitution of four 10-inch guns in place of four 8-inch guns on the Maryland class, and adding two 6-inch guns to the fourteen on the Maryland class. The general features and dimensions of these vessels are as follows: Length, 502 feet; breadth, 72 feet 10½ inches; displacement, 14,500 tons; mean draft to bottom of keel at trial displacement, 25 feet; maximum displacement, 15,950 tons; mean draft, 27 feet; coal, 900 tons; bunker capacity, 2000 tons; steaming radius at 10 knots per hour, about 6500 knots; at full speed, about 3100 knots; the maximum speed is not less than 22 knots, and the maximum I. H. P. (estimated) for this speed, 23,000; for hull and machinery, $4,659,000 has been appropriated. The draft of these vessels is limited by the depth of the harbors of the United States. The hulls are to be of steel, with the usual cellular subdivisioning. The inner bottom has been continued from the keel to the protective deck, at each side, and extends forward and aft to about the knuckle of the keel, so that the vessels are thoroughly protected from injury in case of grounding, throughout any point in their length. The freeboard of these vessels at the line of the main deck is about 18 feet, amidship, 24 feet, forward, and 21 feet 6 inches aft. By reason of the high freeboard, commodious

quarters are provided for all officers and men above the water-line. The conning-tower, located on the lower bridge, is one deck higher than in earlier designs. The hull is protected by a 5-inch belt of armor extending from five feet below the normal water-line to the upper deck in wake of 6-inch guns, this armor extending to the bow and stern near the water-line to form a water-line belt, being reduced in thickness at the ends to three inches. Extending from the gun deck to the protective deck are bulkheads of 5-inch armor, which form the forward and after limits of the belt armor. Between the gun and berth decks are similar bulkheads located in wake of the 10-inch barbettes which are fitted on the gun deck and form the forward and after limits of the side armor between the main and gun decks. Above the gun deck, in wake of the 3-inch battery, 2-inch nickel steel is fitted. The 6-inch guns on the gun deck are isolated by splinter bulkheads of 1½-inch nickel steel, extending continuously across the ship, and 2-inch nickel steel extending fore and aft.

The 10-inch turrets are protected by nine inches of armor on the sloping face, seven inches of armor on the sides, five inches in the rear, and with top plates of 2½-inch nickel steel. The barbette armor is seven inches thick in front, reduced to a thickness of four inches at the back and below the gun deck, where protected by the belt and casemate armor. The protective deck, which extends from bow to stern, will be one and one-half inches thick on the flat, over the engine and boiler spaces, four inches thick on the slopes at the side, extending down to the bottom of the belt armor, three inches on the slope, forward and aft. A cofferdam, thirty inches thick, will be worked from end to end of the vessel between the protective and berth decks. These cofferdams will probably be filled with water-excluding material. The secondary battery is twenty-two 3-inch rapid-fire guns, twelve 3-pounder semi-automatic guns, two 1-pounder automatic guns, two 1-pounder rapid-fire guns, two 3-inch field pieces, two machine guns of 30-caliber and six automatic guns of 30-caliber. It will be seen that this battery is more powerful than that of any similar vessel in the world. The 10-inch guns will be mounted in two eliptical, balanced turrets located within cylindrical barbettes, extending from the protective deck, to well above the main deck, and turning through arcs of 270 degrees. The 6-inch guns will be mounted, four in independent, armored casemates on the main deck, the remainder in broadside on the gun deck, all on pedestal mounts, the back and side plates of the casemates on main deck being of 2-inch nickel steel. At each end of the vessel, four of the 6-inch guns can be trained directly ahead or directly astern, so that it is possible to obtain a direct ahead fire with the main battery of two 10-inch and four 6-inch guns, and the same number at the stern. All of the 6-inch guns can be trained through a complete angle of about 115 degrees each. The 6-inch guns are so arranged that the muzzles are trained inside the line of side armor, thus leaving the side clear and unobstructed while going alongside a dock or vessel, or when coaling. The 3-inch guns will be mounted as follows: Six on sponsons on the gun deck, six in broadside on the gun deck, and ten in broadside on the main deck. The protection of these guns is as described above. Arrangements will be made for quickly and conveniently dismounting the 3-inch guns in broadside. The 3-pounders and smaller guns are mounted on the upper deck, bridges, in the tops, and wherever they can secure the most commanding positions, to be ready at all times for repelling torpedo boat attacks and for inflicting damage upon the unprotected portion of an enemy's ship.

The ammunition and shell rooms are so arranged that about one-half the total supply of ammunition will be carried at each end of the ship. The remaining ammunition is stowed where it can readily be whipped up by hand, when time is available, from the lower to the upper platform.

For handling ammunition along the central passage, there will be

ammunition conveyors. Provision has been made by means of power hoists, to handle the 6-inch and 3-inch and 3-pounder ammunition, at the rate of seven pieces a minute. In addition to the power supply, there has been provided sufficient means for a supplementary supply of ammunition by hand, to interfere as little as possible with the power handling, so that, with the combined means of supply, it will be possible to supply ammunition to all of the guns at a rate equal to that at which they can be fired.

Wood work has been reduced to a minimum, and all such above the protective deck, except deck planking, armor backing, furniture, and a few minor items, will be fireproof.

Special attention has been given to the coaling of these vessels. It is the intention to hoist the coal over all, and to lower it directly through large hatches to the gun deck, where it can be handled on trucks to the various scuttles, thus avoiding the fitting of a large number of scuttles on the gun and main decks, and the fitting of portable coal chutes.

Provision has been made sufficient to carry with ease the full complement of officers and men. The boats will be handled by four electrically operated boat cranes.

The full complement of the vessels, as flagships, will consist of one flag officer, one commanding officer, chief of staff, nineteen wardroom officers, twelve junior officers, ten warrant officers, 814 men. The masts will be fitted for the installation of wireless telegraphy.

All spaces in officers' quarters, bounded by the outer hull, will be sheathed with asbestos or other suitable non-conducting material. All iron work exposed direct to the action of the weather on the opposite side will be cork painted.

The ventilation system is to be most thorough, especial attention having been given to all details of the design in this respect. By increasing the number of ventilating units, it has been possible to avoid piercing any of the main transverse or longitudinal bulkheads below the protective deck, and to largely avoid the use of automatic valves.

The engine and fire-room trunks are sheathed with asbestos to further increase the habitability of adjoining spaces. Special attention has been given to the design of all of the water systems, to reduce the quantity of piping necessary, and to increase their efficiency.

The propelling engines will be of the vertical, twin screw, four-cylinder, triple-expansion type, of a combined I. H. P. of 23,000. The steam pressure will be 250 pounds, and the stroke four feet. A speed of the main engines of 120 revolutions per minute is requisite to a speed of 22 knots. The diameters of the high pressure and low pressure cylinders will be in the ratio of 1 to 7.3. The engines will be located in two separate water-tight compartments. Steam, at a working pressure of 250 pounds, will be supplied by sixteen boilers of the straight water-tube type, placed in eight water-tight compartments, having combined grate surface of at least 1590 square feet, and heating surface of at least 68,000 square feet. Forced draft will be on the closed fire-room system. There will be four funnels on each vessel, each about 100 feet high above the keel line. Feed water will be carried in the double bottoms. The vessels are to be heated by steam throughout.

There will be a refrigerating plant of the Dense Air type, with a cooling effect equal to a daily output of three tons of ice. There will be an evaporating plant of not less than four units, having a total capacity of 25,000 gallons of potable water per day, and a distilling apparatus capable of distilling at least 10,000 gallons of water per day.

The vessels are to be provided with a laundry, capable of washing for 100 men per day; also with a bakery, and all fittings for the operation of a general messing system.—*Army and Navy Journal.*

REMARKS ON THE NEW DESIGNS OF NAVAL VESSELS.*

By Rear-Admiral Francis T. Bowles, Chief Constructor, U. S. N.

In the preparation of the recent designs for the battleships of the Connecticut class and the armored cruisers of the Tennessee class, consideration has been given to matters affecting the time required for completion. Up to the present ten battleships for the navy have been built and completed by contractors, and the average time required from the date of the contract until the date of the first commission has been four years and eight months, varying from a minimum of four years and one month to a maximum of five years and eight months. These periods are too great and disadvantageous both to the Government and to the contractor, as the Government fails to obtain the use of its property, and the cost of construction is undoubtedly increased. The causes of the delays which have occurred in the construction of naval vessels are numerous and need not be recited here. The one conspicuous cause which it was possible for the Government to remedy has been taken in hand in these designs and it is hoped eliminated. The contract plans now issued to the contractor, as shown in the annexed list, are very complete so far as all general features of the structure and arrangements of the vessel are concerned. The specifications have been arranged in a logical order, and have been made in all particulars definite and conclusive, instead of leaving many items of importance to the vessel and involving a large element of cost to the discretion of the superintending naval constructor or "as may be required."

The steel structure is composed wholly of plates and shapes of commercial sizes. All shapes which have heretofore been used for naval vessels only have been discarded, having in view not only cheapening the cost of construction, but obtaining prompt deliveries of steel; the latter being a result never attained in practice when special shapes and small quantities are demanded. The number of structural shapes in the battleships has been reduced to twenty-four, each size of angle bar being counted as a separate shape. Channel bars are used for beams and bulkhead stiffeners.

The contract period of construction for the battleships and armored cruisers has been placed at forty-two months. It is believed that the complete and accurate state in which the plans and specifications have been issued is equivalent to a gain of six months over the time required to complete preceding vessels, and that there is a fair prospect of securing the completion of these vessels within the contract period, a result which has never yet been attained.

There are a number of special features, and some entirely novel ones contained in these designs affecting their military value; and while criticism of the Society on any features which are obvious is expected and desired, it does not appear to be in the interests of the Government that they should be discussed nor explained in this paper.

The increase in size of naval vessels, which has been common to all navies in recent years and coincident with the increase in size of vessels in the merchant service, has been a subject of remark, and is a matter that will bear some careful consideration. Increase in size may be expected to involve decrease in handiness, but it does not necessarily do so; it does, however, practically always involve increase in cost.

The problem of the naval architect should be to produce the best military unit for the least amount of money, and it remains for those who command naval vessels to say what limit of military power shall be placed upon the individual unit of the fleet. A distinguished foreigner

* Read at the tenth general meeting of the Society of Naval Architects, New York, Nov. 10, 1902.

recently asked why our battleships were so large, or of so great displacement, and was told in answer that the conditions of our service seemed to make it necessary for our battleships to go anywhere and be ready to fight when they get there. While our recent battleships are undoubtedly large, the Virginia class of five vessels being 14,980 tons normal displacement, and the Connecticut class 16,000 tons normal displacement, there are unquestionably great advantages obtained in the individual power of the battleship, as compared with its smaller predecessors. On the other hand, it is undoubtedly well for naval officers to consider whether the necessary military power could not be secured with about the same battery and armor protection, but less speed and coal capacity.

It should not be forgotten, too, that our naval designers are handicapped when it comes to very large ships by restrictions of draft more severe than those of many foreign powers.

In making comparisons to show the advantages of increase in size, they should be made between ships which are tactically comparable, that is, of practically the same speed and whose motive power and battery are of substantially equally modern design. In comparison in figures and percentages easy of comprehension, to show the effect of the increase in size of our own battleships, can be made between the Alabama and Maine classes (our most recently completed classes) considered together as being practically about 12,000 tons displacement, and the Connecticut class of 16,000 tons. The cost of the Maine and Alabama classes, complete, is about $6,000,000 each. The cost of the Connecticut class is about $7,500,000 each. The displacement has been increased 33 per cent in passing from the Maine and Alabama to the Connecticut. The cost of four Connecticuts will equal the cost of five Maines and Alabamas. The weight devoted to battery and ammunition in the Maine and Alabama is 1003 tons, and in the Connecticut 1340 tons. Therefore, by increasing the displacement of the Maine and Alabama by 33 per cent, there has been a corresponding increase in the weight of armament carried. The weight of the discharge of one round from all the guns of the Maine and Alabama, above 6-pounders, is 5312 pounds, whereas the weight of the discharge of one round from all guns above 6-pounders on the Connecticut is 7856 pounds, or an increase of 47.9 per cent. Therefore, for an increase of one-third in size there has been a gain of nearly one-half in effective battery power. Thus, if the battery power of the Maine and Alabama be considered unity, that of the Connecticut will be 1½; and for $30,000,000 four Connecticuts can be built, with a battery power of six, and five Maines and Alabamas, with a battery power of five. In the case of the Maine and Alabama the weight devoted to armor protection amounted to 2770 tons, and on the Connecticut to 3992 tons, thus showing an increase in protection of 44 per cent for an increase in size of 33 per cent.

These illustrations of the enormous gain in offensive and defensive power of these vessels, corresponding to the increase in size, are well known parallels of the greater cargo efficiency of the larger vessels in the merchant service, which is due to the fact that the larger vessel requires a less proportion of hull and machinery weights than the smaller for the same results in strength and speed.

If similar comparisons were made of the Connecticut with the Oregon class, there would appear an increase in displacement of 55 per cent, an increase in the weight of armament and ammunition of 56 per cent, an increase in protection of 36 per cent, but an increase in the weight of battery discharge per round of only 10½ per cent. But these comparisons are of little force on account of the low speed of the Oregon, the inefficient gun mountings as compared with that of more modern vessels, and the inadequate armor protection. It should be remarked that the ar-

rangement of the battery of the Oregon class is probably unsurpassed, and that it has furnished a type followed by other designers than our own.

A similar comparison with the Kearsarge and Kentucky, larger vessels of practically 12,000 tons displacement, shows an increase of 14 per cent in the weight of armament and ammunition, 34 per cent in protection, and 20 per cent in the weight of discharge of battery per round. The Kearsarge is an excellent illustration of what can be accomplished in large battery power, moderate speed (16 knots), and small coal supply. Discussions of the Kearsarge and Kentucky, based upon normal displacement are, however, somewhat misleading, owing to the fact that certain circumstances of their design necessitated reducing the coal carried on normal draft to 410 tons.

The advantages of the increase in size and length of the Connecticut are clearly shown with reference to the elements of speed and power. Model basin trials show that at a speed of 18 knots the power required for the Connecticut is about 6 per cent less than that required for the Maine; whereas, at 19 knots the power required for the Connecticut is nearly 50 per cent less than that for the Maine.

The normal displacement of the Tennessee class is 14,500 tons, an increase of 6 per cent over that of the Pennsylvania class of six vessels now building of 13,680 tons. Certain features of the new designs have permitted this increase to be almost wholly devoted to armament and armor, thereby producing, at slight additional cost, very much greater military power. The addition to the weight of guns and ammunition carried amounts to 29.7 per cent over that on the Pennsylvania class, and produces an increase in the weight of one discharge of the battery, amounting to 47.4 per cent. The increase in the weight of protection carried amounts to 30 per cent of that on the Pennsylvania class, and is devoted to an increase in the armor on the turrets and the redoubts of the 10-inch guns, which replace the 8-inch guns in the forward and after turrets on the Pennsylvania class, and to an increased area of side armor, affording ample protection to the magazines and the supply of ammunition to all guns, and also to a complete subdivision of the main battery by armor bulkheads.

The estimated speed of the Tennessee class is 22 knots, the same as the designed speed of the nine cruisers now building of the Pennsylvania and St. Louis classes, and will be effected without an increase in machinery weights.

These vessels will be exceeded about a knot in speed by a few foreign armored cruisers, but if their designs had been made upon the prime requisite of speed superior to all vessels of this category, it would have been necessary to sacrifice the battery and protection now assigned which enables them to present a heavy preponderance of battle power over any armored cruisers yet designed elsewhere, and also enables them to deal on occasion with a large proportion of existing battleships.

BATTLESHIPS.

MEASUREMENTS.

Length over all ....456 ft. 4 in.
Length on L. W. L. ....450 ft. 0 in.
Breadth, extreme ....76 ft. 10 in.
Mean draft to L. W. L. ....24 ft. 6 in.
Maximum draft at full load ....26 ft. 9 in.
Displacement to L. W. L, 16,000 tons; full load, 17,770 tons.
Freeboard, minimum at full load forward, 18 ft. 3 in.; aft, 17 ft. 9 in.
Normal coal ....900 tons.
Tons per inch at L. W. L. ....63.16 tons.
Moment to change trim one inch at L. W. L...............1544 ft. tons.

Trans. G. M. normal load, 4.42 ft.; long G. M., 521.22 ft.
Range stability normal load ....68 deg. 18 ft.
Angle maximum stability ....39 deg. 21 ft.
Area of rudder, 288 sq. ft.; type, balanced.

PROPELLING MACHINERY.

Engines, No. 2; type, vertical triple expansion.
Diameter cylinders H. P., 32½ in.; I. P., 53 in.; L. P., 2 of 61 in.
Stroke, 48 in.
Screws, No. 2.
Boilers, No. 12; type, Babcock & Wilcox.
Grate surface, total, 1100 sq. ft.; heating, 46,750 sq. ft.
Steam pressure, designed, 250 lbs. at engines, 265 lbs. at boilers.
Trial.
Designed speed, 18 knots; trial speed, forced draft.
I. H. P., 16,500.

COMPLEMENT.

Admiral, 1; Chief of Staff, 1; Captain, 1; Ward-room Officers, 19; Junior Officers, 10; Warrant Officers, 10; Crew, 701; Marines, 60. Total complement, officers, 42; crew, 701; marines, 60.

ORDNANCE.

Main Battery.

Four 12-in. B. L. R., .40 cal.
Eight 8-in. B. L. R., .40 cal.
Twelve 7-in. R. F., .45 cal.

Secondary Battery.

Twenty 3-in. R. F., .50 cal.
Twelve 3-pdr. S. A.
Six 1-pdr., automatic.
Two 1-pdr. S. A.
Two Gatling, .30 cal.
Six automatic Colts, .30 cal.
Two 3-in. field guns.
Torpedo tubes, none.

Ammunition.

12-in. rounds per gun, 60.
8-in. rounds per gun, 100.
7-in. rounds per gun, 100.
3-in. rounds per gun, 300.
3-pdr. rounds per gun, 600.
1-pdr. rounds per gun, 960.
.30 cal. automatic.

PROTECTION.

Armor.

(a) Water-line belt, top, 11 in.; Bottom, 9 in.; decreasing to 9 in.; 7 in., 5 in., 4 in.
(b) Upper casemate, 7 in.; lower casemate, 6 in.
(c) Upper athwartship, 7 in.; lower athwartship, 6 in.
(d) Barbettes $\begin{cases}\text{12 in., 10 in., and 7½ in.}\\ \text{8 in., 6 in., and 4 in.; sponson, 2 in.}\end{cases}$
(e) Turrets 12 in.—12 in., and 8 in.
8 in.—6½ in., and 6 in.; diagonal, none.
(f) Conning tower, 9 in.; signal tower, 6 in.
(g) Tube, 6 in.
Protective deck, ½-in.
Slopes, forward, 2½ in.; midship, 2½ in.; aft, 2½ in.; flat, 1.

Armored Cruisers.

MEASUREMENTS.

Length over all ....504 ft. 6 in.
Length on L. W. L. ....502 ft. 0 in.
Breadth, extreme ....72 ft. 10½ in.
Mean draft to L. W. L. ....25 ft. 0 in.
Maximum draft at full load ....27 ft. 0 in.
Displacement to L. W. L., 14,500 tons; full load, 15,950 tons.
Freeboard, maximum at full load forward, 21 ft. 3 in.; aft, 18 ft. 6 in.
Normal coal ....900 tons.
Tons per inch at L. W. L. ....59.70 tons.
Moment to change trim one inch at L. W. L. ....1483 ft. tons.
Trans. G. M. normal load, 3.30 ft.; long G. M., 616.25 ft.
Range stability, normal load, 72 deg., approximate; angle maximum stability, 41 deg., approximate.
Area of rudder, 263 sq. ft.; type, balanced.

PROPELLING MACHINERY.

Engines, No. 2; type, vertical inverted 4-cylinder triple-expansion.
Diameters cylinders H. P., 38½ in.; I. P., 63½ in.; L. P., 2 of 74 in.
Stroke, 48 in.
Screws, No. 2; diameter, 18 ft. 0 in.; pitch, 22 ft. 0 in.
Boilers, No. 16; type, water tube.
Grate surface, total, 1590 sq. ft.; heating, 68,000 sq. ft.
Steam pressure, designed, 265 lbs. at boiler, 250 at engine.
Trial.
Designed speed, 22 knots; trial speed, forced draft.
I. H. P., trial, 23,000.

COMPLEMENT.

Admiral, 1; Chief of Staff, 1; Captain, 1; Ward-room Officers, 19; Junior Officers, 12; Warrant Officers, 10; Crew, 754; Marines, 60. Total complement, officers and crew, 858, as a flagship.

ORDNANCE.

Main Battery.

Four 10-in. B. L. R., .40 cal.
Sixteen 6-in. B. L. R., .50 cal.

Secondary Battery.

Twenty-two 3-in. (14-pdrs.) R. F. guns, .50 cal.
Twelve 3-pdr. semi-automatic guns.
Two 1-pdr. automatic guns.
Two 1-pdr. R. F. guns.
Two 3-in. field pieces.
Two machine guns, .30 cal.
Six automatic guns, .30 cal.
Torpedo tubes, none.

Ammunition.

10-in. rounds per gun, 60.
6-in. rounds per gun, 200.
3-in. rounds per gun, 300.
3-pdr. rounds per gun, 500.
1-pdr. rounds per gun, 1380.
.30 cal. automatic.

PROTECTION.

Armor.

(a) Water-line belt, 5-in.; 3 in. at ends.
(b) Casemate, 5 in. in wake of 3-in. guns; 2 in. N. S.

(c) Casemate athwartship, 5 in.; casemate athwartship, 5 in.
(d) Barbettes, 7 in. and 4 in.; sponsons, 2 in. N. S.
(e) Turrets, 9 in., 7 in., and 5 in.; diagonal, 5 in.
(f) Conning tower, 9 in.; signal tower, 5 in.
(g) Tube, 5 in.
Protective deck, ½ in.
Slopes, forward, 2½ in. N. S.; midships, 3½ in. N. S.; aft, 2½ in. N. S.; flat, 1 in. N. S.

VESSELS RECENTLY COMPLETED.—Within the last few months a number of vessels that have been under construction have had their trials and have been delivered to the Government. There are the monitors Arkansas and Wyoming, which made a speed of 12 knots; six destroyers, all of which made speeds of about 28 knots; and two submarine boats, whose trials have been declared to be satisfactory.

Concentration of the naval force into two big fighting squadrons in North Atlantic and Asiatic waters is recommended by Rear-Admiral Henry C. Taylor, chief of the bureau of navigation, in his annual report. For the present, the report says, two squadrons are all the present number of battleships will permit. To carry out this policy Admiral Taylor proposes to transfer the battleships in the remaining squadrons to one of the other of these heavy squadrons, and compose the Pacific, European and South Atlantic Squadrons entirely of cruisers. These changes will be undertaken as soon as the winter maneuvers in the West Indies are ended. After the rearrangement the distribution of the fighting force of the navy will be as follows:

North Atlantic Station—The Kearsarge, the Alabama, the Massachusetts, the Indiana, the Maine, the Illinois, the Iowa and the Texas. This force should be maintained in the future at not less than eight battleships.

Caribbean Division of North Atlantic Station—The Olympia, the Montgomery, the Marietta, the Machias, the Panther and the Detroit.

Asiatic Station—The Kentucky, the Oregon, the Wisconsin, the Monadnock and the Monterey. The battleships in this squadron are to be increased to six as soon as vessels of this class are commissioned.

Cruiser Division of the Asiatic Station—The New Orleans, the Yorktown, the Wilmington, the Helena, the Vicksburg, the Princeton, the Annapolis, the Don Juan de Austria and the Isla de Cuba. The Rainbow and a large gunboat division will, as heretofore, be attached to the squadron for service among the islands and the rivers.

Pacific Station—The New York, the Philadelphia, the Boston, the Marblehead and the Ranger.

European Station—The Brooklyn, the Chicago, the San Francisco and the Albany.

South Atlantic Station—The Newark, the Atlanta and the Nashville.

It is also proposed to form additional torpedo boat flotillas, with a destroyer as the leading vessel, after the plan of the present group now in the West Indies under the command of Lieutenant Chandler.—*Army and Navy Register.*

The following are extracts from the report of the Secretary of the Navy, dated at Washington, November 19, 1902:

Among the most important lessons learned in the war with Spain was that a modern navy can not be improvised during a war or upon the threshold of a war. Much money was then expended in the purchase of ships. Many of them served useful auxiliary purposes, but it may well be doubted whether they added materially to the fighting efficiency of our fleet. The time best suited to the development and

perfection of our navy is the time when there is neither war nor threat of war. Happily the present is such a time, and it permits a dispassionate consideration of the future.

The country approves. with hardly a dissenting voice, the policy of strengthening our power upon the sea. What would have been an adequate navy some years ago is totally inadequate for the performance of the duties growing out of our new possessions in the Pacific and Atlantic and the determination of Congress to construct a canal across the Isthmus.

If, then, the policy of strengthening our power upon the sea to the point where it can respond to the national needs be not abandoned, the navy has manifold needs. There must be additional naval and coaling stations; more ships, fighting and auxiliary; and an increase of officers and men. In all of these respects, Congress in the past has dealt with the navy wisely and generously, and I doubt not that in the future it will as accurately register the will of the people.

The most imperative need of the Navy to-day is of additional officers. I can not overstate this need. It invites the instant attention of Congress. The administration of the department is embarrassed almost daily by the lack of officers below command rank. This condition has been approaching for some years, and was clearly apprehended and stated by my predecessor in office. It is acute to-day, and, when the ships already authorized are completed, it will be desperate unless there is early action.

A statement of this kind can not safely rest upon mere assertion, but demands verification by a comparison of the number of officers with the duties which are required of them. Recognizing clearly that the same deficiencies exist in the staff corps and that an enlargement of them is urgently demanded, I will nevertheless here make the comparison solely with respect to the officers of the line, selecting the 1st day of October last as a recent date illustrative of the present condition. Following is a table descriptive of the conditions then existing:

Number of line officers, including midshipmen, required for vessels now on the navy list	1206
Officers on inspection, court martial duty, Naval Academy, recruiting, ordnance, equipment, and engineering duty	264
In transit to and from stations	70
Sick	30
Leave or waiting orders	30
Total	1600
Number of officers now on navy list, including midshipmen after graduation	1023
Deficiency	577

In the above table only the serviceable ships of the Navy are included, and to them there is allotted only the minimum number of officers required, the allowance being less than that made in the other navies of the world. It is too obvious to need more than mention that with squadrons in Pacific, Asiatic, European, North and South Atlantic waters, there must always be a certain number of officers in transit from one point of duty to another, and for the time being withdrawn from active duty.

In considering the effect of this table it must be remembered that ordinarily in peace a considerable portion, say one-quarter, of the serviceable ships would be out of commission undergoing repairs and improvements, and that thus approximating three hundred officers would be released for other duty. Even in such case, and by the detachment

of officers from every point of duty on shore where the law and the absolute requirements of the service would permit it, we could not in time of peace officer three-quarters of our present fleet.

But any comparison which does not take into account at least the future which is in sight would be totally inadequate, and therefore I project the comparison into the four years of our immediate future. The following table shows the number of combatant ships in course of construction and authorized and the number of officers necessary for them:

Vessels.	Officers.	Vessels.	Officers.
Maine	17	Des Moines	12
Georgia	17	Chattanooga	12
Pennsylvania	17	Tennessee	15
Rhode Island	17	Washington	15
Louisiana	17	Arkansas	7
California	15	Nevada	7
Nebraska	15	Wyoming	7
West Virginia	15	Paducah	7
Maryland	15	5 submarines	5
Colorado	15	Cleveland	12
South Dakota	15	Galveston	12
Connecticut	17	Tacoma	12
Ohio	17	Florida	7
Virginia	17	Dubuque	7
Missouri	17	13 torpedo-boat destroyers	39
New Jersey	17	7 torpedo boats	14
St. Louis	12		
Milwaukee	12	Total officers necessary for the new vessels, for which no provision has been made	498
Charleston	12		
Denver	12		

The importance of these ships is seen at a glance. Allowing the same proportion of officers in transit, on shore duty, sick, and on leave, will require 623 officers to produce the 498 demanded by our new ships. In these four years, moreover, it is estimated that not less than 160 officers will leave the service through resignation, retirement, or death. The deficiency in the number of officers required for the full complement of naval duty as indicated above will be at the end of four years as follows:

Present deficiency	577
Needed for new ships	623
Needed to fill vacancies	160
Total deficiency	1360

I am informed that under existing conditions 355 graduates of the Naval Academy may be expected during these four years. There is no other source of supply except a number, not exceeding six per annum, which may be obtained by the promotion of enlisted men. Unless, therefore, the above computation can be shown to be erroneous, we shall have in the near future something more than a thousand officers less than the proper complement.

The officers we need can be obtained from three sources only—by appointment from civil life, by promotion from the ranks, or by education and training at the Naval Academy. The first source has been so uniformly rejected by the opinions of all, that I will not discuss it. Congress has indicated its opinion by abandoning this method in the Marine Corps, and would not, it is assumed, adopt it for the line of the navy. The law already allows promotion from the ranks of not exceeding six enlisted men per annum. The provision of the law is as follows:

"Whenever, in view of the vacancies in the grade of ensign on July

30 of any year unfilled by graduates of the Naval Academy, the secretary of the navy shall so recommend, the President may appoint to that grade, as of July 30, from among the boatswains, gunners, or warrant machinists, not exceeding six in any one calendar year. No person shall be so appointed who is over thirty-five years of age; who has served less than six years as a warrant officer; who is not recommended by a commanding officer under whom he has served; nor until he shall have passed such competitive examination as may be prescribed by the Navy Department."—Act of March 3, 1901.

Under this law there have been up to the present time three warrant officers commissioned as ensigns: Henry B. Soule, formerly a gunner, appointed an ensign from the 30th day of July, 1901; Francis Martin, formerly a gunner, appointed an ensign from the 30th day of July, 1901; Louis J. Connelly, formerly a gunner, appointed an ensign from the 30th day of July, 1902.

I recommend that this law be amended so as to permit the promotion of not more than 12 per annum.

But the main source of our supply of officers must be from the Naval Academy. The duties of the modern naval officer are so varied and complex that they demand a rigorous and protracted education and training. This training and education can best be obtained at the national school at Annapolis. That school produces officers the equal of any in the world. When the best are obtainable, we need not content ourselves with anything less than the best. The nation has devoted many millions of dollars to the upbuilding of this school, instituted and maintained for the single purpose of producing naval officers of the highest type.

With the utmost wisdom, Congress has prescribed that the students shall be selected in uniform proportions from all sections of our country, and, in practice, all classes of our people are represented there. Naval officers do not constitute a caste; our system of selection brings to our service each generation the new blood of our democracy. It admits none by favor; it excludes all except those of the highest mental and physical vigor. Thus selected, thus educated, inspired by our naval traditions, we may be assured that these young men will reach and maintain the highest standard of efficiency.

I therefore earnestly recommend that without a year's delay the number of midshipmen at the academy be increased sufficiently to meet present and prospective needs of the service.

It should be stated that as the Navy is now constituted there is and will be in the immediate future a sufficient number of officers above the rank of lieutenant commander. The increase should be in the number of lieutenant commanders, lieutenants, and ensigns, and care can and should be exercised to prevent stagnation in promotion, in order that officers may attain command rank at a sufficiently early age for reasons which are so obvious and have been so frequently stated that they need no repetition.

It has sometimes been suggested that the insufficiency of officers is due in part, at least, to the number detailed for the performance of shore duty. This suggestion demands careful consideration. The number of officers on shore duty is to some extent within the control of the secretary of the navy and to that extent is a question of administration merely.

The efforts of my predecessor and myself have diminished the number of line officers on shore duty from 275 on January 1 last to 203 on November 15 current, being a reduction of 72, or 28 per cent. The percentage of officers on shore duty on January 1 was 26.8, and on November 15 was 19. This reduction has not been accomplished without the protest of some of the ablest officers, especially those at the heads of the several bureaus. The weight of this protest is not overlooked, and it is recog-

nized that in some cases the action of the department can only be justified by the fact that officers have been detached from stations on shore for the performance of more essential duties at sea. There follows a table showing the detail of the above statements, and a list of the officers serving on shore duty on November 15, with the positions which they respectively fill. [List omitted.]

Number of officers available for sea duty performing shore duty:

Rank.	Jan. 1, 1902.		Nov. 15, 1902.	
	Number.	Per cent.	Number.	Per cent.
Rear-admirals	14	51.4	15	51
Captains	36	50	34	46.6
Commanders	50	42.7	45	38.5
Lieut.-commanders	58	33.1	52	30.2
Lieutenants	81	26.4	44	14.6
Lieutenants, J. G.	36	46.1	12	12.7
Ensigns	0	.0	1	.7
Midshipmen	0	.0	0	.0
Total on shore	275	26.8	203	19
Of line officers in service	1023		1045	

Reduction of officers on shore, 72, or 28 per cent.

It will be observed that the reduction in the number of officers on shore duty has been almost entirely in those of the grades from lieutenant-commander down, of whom there are now only 109 out of 707 on shore duty. The demand upon the officers of those grades has been great both at sea and on shore, at sea because they are the watch officers, on shore because they have been thoroughly educated, especially the younger of them, in the recent development of technical subjects which in the modern navy are of the highest importance. These officers have responded nobly to the demands of the service and have met every duty required of them. They deserve the approval of the country, as they receive the commendation of the department.

Shore duty can not be abolished entirely. An examination of the shore stations now occupied shows that many of them are prescribed or contemplated by law, and many, if not most, of the others are essential to the proper development of the navy and can not be discontinued without imperiling its efficiency. There is another aspect of duty on shore which can not safely be disregarded, and that is its effect on the individual officer. He can not be properly developed for the responsibilities of command of the complicated mechanisms which float under the names of battleships and cruisers without the knowledge and experience obtainable only by service at the stations on land. Nor can he, without disregard of the plainest principles of humanity, be required to abandon all family ties.

The difficulty is in administration, to apportion properly among the officers shore and sea duty. Sometimes by favoritism officers of the navy may obtain long tours of duty on shore, necessarily at the expense of others, and sometimes an officer who possesses exceptional scientific equipment is, for that reason, kept upon shore duty so long that his efficiency as a seagoing officer and as a commander of men is endangered.

I shall endeavor to apportion among officers sea and land service as justly as conditions will permit. But it is well worth consideration whether a certain proportion of service at sea should not be required by law as an indispensable condition of promotion. Such requirements are made by law or practice in other navies.

The present number of enlisted men authorized by law is 28,000. By enlistment since the close of the fiscal year, the number of men in the

service has been brought up to 25,258 on November 15, current, and it is believed that by February next the full number authorized will be enlisted. The same reasons which demonstrate the necessity for an increase of officers call for the increase of men. The increase can be made gradually, and I recommend that an addition of 3000 be authorized during the next fiscal year.

Many of our men leave the service at the completion of the first enlistment. One cause of this is that they have received in the service a training which fits them for positions of responsibility in civil life with compensation greater than the navy can afford to pay. Such an education is not wasted but inures to the public welfare. Moreover, it may be hoped that those who leave the navy at the end of a single enlistment would constitute an unofficial reserve which might be drawn upon in time of need.

After most careful consideration, I believe it to be my duty to recommend a continuance without interruption of the increase of ships. The precise type of ships authorized must, of course, like the authorization itself, be referred to the wisdom of Congress, to whose committees recommendations in detail may be made. Differences of opinion exist among naval authorities, but all agree that not less than two battleships should be among the number authorized. Whether the others should be of the armored-cruiser type or of the unarmored-cruiser and gunboat type which have proved so useful, may well be left for future discussion.

There is no subject which deserves more careful consideration than that of naval stations. Their situation and development have sometimes been controlled more by accident and local wishes than by the broader consideration of national needs. We surely have an abundance of them within the United States, but there is imperative demand for the establishment of a naval station in the Philippines and in the West Indian islands or the Carribbean.—From the Secretary's report as published in the *Army and Navy Register.*

AMMUNITION.

Le Yacht publishes an article on the different kinds of shell at present in use in the French navy. The ordinary shells are of two kinds—those in cast iron, and those of "demi-explosion" in steel. The first have a thickness of from one-fifth to one-sixth of their calibre. Those of a calibre of 4 inches or more are charged either with black powder or with melinite. Numerous experiments have been carried out on the hulls of old armored warships, and notably La Galissonnière at Cherbourg has been used as a target. The results have not been made public, either of the experiments at Cherbourg or of those previously carried out at Toulon and at Gavres; but they have sufficiently demonstrated the importance of light armor, of the development of a system of small compartments above the chief armor deck, and of the addition of protection against shell splinters. Whether charged with gunpowder or melinite, the shells do enormous damage, projecting plinters of shell and fragments of the armor-plates into the interior of the vessel struck, setting alight, when charged with gunpowder, to anything inflammable, and, when charged with melinite, giving forth a deleterious gas. When fired at hand fortifications, the melinite shells were the more destructive of masonry, and the gunpowder shells of life. The shells of demi-explosion, though never yet used in war, have long been carried on board French ships. They have a cap or mantle of hard steel, which enables them to pierce armor of moderate thickness and then to burst

in the rear of it. They are made in all calibres between 3.93-inch and 13.98-inch; they are longer than the cast-iron shells, and their walls are from one-sixth to one-seventh of their calibre in thickness. Though their bursting charge is not so powerful as that of the iron shells of the same calibre, its force is all expended on the interior of a vessel or fort, and the explosion, therefore, is far more destructive especially when melinite is used. The 12-inch guns of the model 1893-6, with which the more recent French battleships are armed, will throw one of these shells with a muzzle velocity of 900 metres (2952 feet), and pierce slightly more than 3¼ feet of iron at a distance of 546 yards (1 metre of iron at 500 metres), which, according to the writer in *Le Yacht*, is more than equal to the performance of American and English guns and shells. Shrapnel shells are not much used in the French navy; but in some experiments carried out recently in the French Mediterranean squadron, it was found that the balls with which they are filled easily penetrate the plates of torpedo boats, and send these boats quickly to the bottom.—*Engineering.*

DOCKS.

THE CUNNINGHAM DRY DOCK.—This dock, instead of being composed of independent side walls and pontoons, consists of a series of sections, each of which is an independent dock in itself, but when connected together practically form one dock. The sections are joined together end to end, and the joint flanges are of such an extent and location that the joint is readily made of greater strength than the body of the section. The machinery has all been placed on one side which has the advantage of bringing all the operations governing the manipulations of the dock directly under the observation and management of the operator. When assembled for operations, the main pipes of all the sections are connected to each other by slip-joints, so that with the pumping plant on the one section alone the entire dock can be operated. The sections are all exactly alike and are consequently interchangeable in positions.

The self-docking is a simple operation, the joints of the section to be docked are opened, the adjacent sections sunk and reconnected, and when pumped up bring the section to be docked out of the water to any desired amount. Under normal conditions the joints are always above water, where they are not subject to corrosion and can have constant attention. In opening the joints of the dock the water is first allowed to run to a uniform depth in all sections without special regard to what the depth is, and as the sections are all alike the flotation of each is practically the same. As it is impossible to so construct the sections that each will have absolutely the same weight, a new feature has been added to facilitate the disconnection in the slotted holes that are made in the connection flanges. The bolts through these slotted holes give sufficient frictional resistance to hold the sections in line against any small difference of flotation that may exist, the balance of the bolts are removed and when the friction bolts are loosened the sections slip to their flotation line without binding or shearing of any parts.

When the ship increases in length beyond the possibility of the dock, a new section is built and connected at the end or any intermediate point. This dock also admits of more rapid construction and safer launching and towing, as each section can be built independently and at the same time, and launched and towed by itself.

As a military dock the Cunningham type has possibilities possessed by no other floating dock. The sections composing a dock can be separated into groups and ordinarily used for docking small vessels, and united in a short time for docking a battleship.—*Army and Navy Journal.*

LIQUID FUEL.

Extract from report of Secretary of Navy, 1902:

From time to time during the past forty years attempts have been made by various foreign governments, as well as by our own, to utilize oil as a fuel for naval purposes. The principal objects sought to be accomplished by such substitution are the reduction of the complement of men in the fire-room, extension of the steaming radius of war vessels, and the attainment of maximum speed at short notice. By reason of important discoveries of crude petroleum a great impetus has recently been given to the use of oil as a fuel. The military value of these discoveries is enhanced by the fact that the oil wells have been found near tide water, thus permitting their product to be delivered at comparatively slight cost to the tanks of deep-draft vessels; and the belief is prevalent that the output of crude oil will increase rather than diminish in the near future.

Congress, at its last session, by a clause contained in the act making appropriations for the naval service for the coming fiscal year, authorized the expenditure of $20,000 "for extended tests of liquid fuel" for naval purposes "from the California and Texas oil fields, under the direction of the bureau of steam engineering, Navy Department." In pursuance of this authorization a series of official experiments have been made since the beginning of the present fiscal year by a board of naval officers. In conducting these tests the board has had at its disposal a thoroughly equipped experimental plant built by private parties for the purpose. Previous to the liquid-fuel experiments an extended series of tests had been made, all under the same boiler, various qualities of coal being used as a combustible, and both natural and forced draft being employed. This boiler was likewise used for conducting the oil tests.

Fourteen official tests have been made, from which valuable information has been secured, and particular attention is invited to the data collected by the board as embodied in the very complete tables printed in connection with the report of the chief of the bureau of steam engineering. In accordance with the law making appropriation for carrying on these tests, the direct purpose of the investigation has been to ascertain the value of liquid fuel for naval purposes; but it has been impossible to conduct such a series of elaborate experiments in a new and important field of research without developing facts of great value to engineering experts pursuing like lines of inquiry in the commercial world. In deference to the widespread public interest in the subject, it has been deemed advisable, although the work of the board is not completed, to submit a preliminary report, giving the information that has already been secured. In the judgment of the members of the board, the experiments thus far made lead to the following conclusions:

1. That oil can be burned under an ordinary boiler in a uniform manner. Whether better results may be obtained by a form of boiler specially designed for the use of liquid fuel is a matter for future determination.

2. That unsatisfactory results are obtained where the attempt is made to burn oil in the same manner as coal. This is believed to have been the cause of many failures in the past.

3. That the best results are obtained by atomization of the liquid fuel, and that the efficiency of the oil burner is proportionate to its power to atomize the oil and convert the minute particles thus obtained into a mixture of combustible gas and fine particles of carbon, in order that complete combustion may result, and, when necessary, the consumption of oil be forced.

4. That the oil before being fed to the burners should be heated. This facilitates atomization, and a high temperature promotes a uniform flow of oil to the burners.

5. That the air requisite for combustion should also be heated before entering the furnace, in order to assist the gasification of the oil product.

6. That either air or steam may be used for atomizing purposes, but that thermal efficiency is not increased by the use of steam.

7. That the consumption of liquid fuel probably can not be forced to quite so great an extent with steam as the atomizing agent as when compressed air is used for such purpose.

8. That when using steam for atomizing the oil high pressures are advantageous.

9. That a marine steam generator can be forced to as high degree with oil as with coal.

10. That under heavy forced-draft conditions it has not yet been found possible to prevent smoke from issuing from the stack, although careful effort so to do was made.

11. That no ill effects upon the boiler were noted as the result of the oil tests.

12. That the efficiency of an oil-fuel plant is more dependent upon the general character of the installation of the auxiliaries and fittings than upon the form of the burner.

13. That firemen generally look with favor upon the substitution of oil for coal.

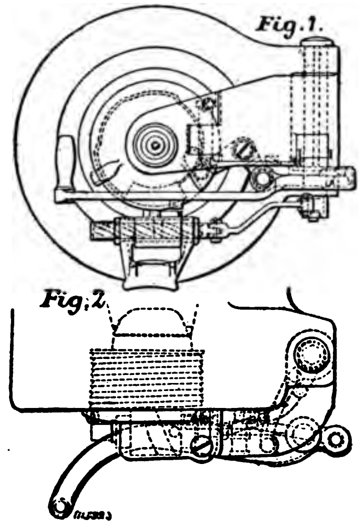
As the result of the investigations thus far conducted the chief of the bureau of steam engineering recommends the installation of liquid-fuel appliances without delay in at least a third of the torpedo boats and destroyers. With respect to the larger war vessels, and particularly the battleships, the installation of liquid fuel presents serious difficulties, entirely apart from the question of the satisfactory use of oil under boilers. The safe and convenient storage of a sufficient supply of liquid fuel beneath the protective decks of large ships of war, and the question of replenishing exhausted fuel supply, whether in time of war or peace, in case of vessels liable to be sent without warning to unfrequented harbors, are grave matters. Inasmuch as such obstacles are more easily dealt with in the case of commercial steamers, the problem of installing liquid fuel upon fighting vessels differs in important features from the same problem as applied to transports or to the mercantile marine.

GUNPOWDER.

New Gunpowder.—A correspondent informs us that the French military authorities are engaged in carrying out experiments on several artillery firing grounds with a new kind of gunpowder. The greatest secrecy is being observed with regard to this new powder, but an expert, who has been present at several experiments with it, has published the following important details: The new powder is distinguished from that now in use by the fact that it can increase, as desired, the initial velocity of the projectiles without thereby increasing the pressure in the barrel of the rifle or big gun. The properties claimed for this powder are so astounding that it was said to be proved during its trials that the velocity of a projectile could be increased from 25 to 40 per cent without the pressure in the gun barrels being increased. Repeated experiments made with the rifles now in use in the different European armies gave the following results: The Männlicher rifle, which has an initial velocity of 525 m. with Russian powder, and of 585 m. with the German powder, attained at the same pressure with the new powder a velocity of 710 m. per second. The English rifle—Lee-Metford—which has a velocity of 560 m. with cordite, attains a velocity of 725 m. with the new powder, and under the same pressure. Similar results were obtained with other rifles, notably, with the French weapon—Lebel. Although the results

with the Lebel rifle cannot be divulged, yet it may be taken for granted that the general excellence of the new invention, even when used with cartridges prepared according to the new method, is confirmed. The increase of the velocity, and, consequently, of the rifle's range, thus becomes immense. But this is not all. By adapting the principles of this new form of ammunition to the infantry rifles, such accuracy of aim has been obtained that it is claimed that, without any exaggeration, every bullet fired can hit a 1f. piece at a distance of 68 yards. The main point which distinguishes this powder from that now in use is the physical condition of the former, which undergoes a change at the very moment of firing the shot. This powder resembles rolled leaves cut into small pieces, which produce just so many results as there are pieces without one atom of the chemical composition being affected thereby. Thus, by using this new powder it is possible by a simple contrivance to regulate and to alter the pressure at will, while by the same means the ignition can be either retarded or accelerated. In this way the moment of ignition and the pressure can be regulated like a watch, and the initial velocity can be increased with mathematical precision, while the pressure in the gun barrel is lessened, and thus the recoil of the rifle is reduced almost to nothing.—*The Engineer*, November 21, 1902.

ORDNANCE.



BREECHLOADING DEVICE.

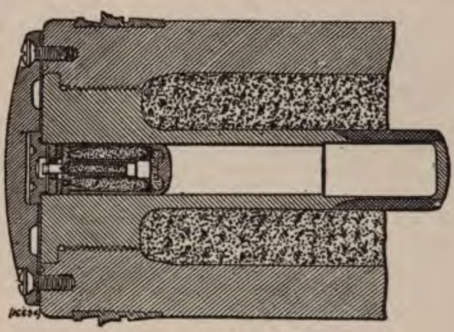
Breechloading Ordnance. — In this breech mechanism the pivot on which the breech-block carrier swings is further forward than is usually the case, and the swinging carrier is formed in two parts, one of which is capable of moving independently with respect to the other by the action of a projection on the breech-block and a cam-like slot or groove in the breech, so formed that in swinging the carrier outwardly about its pivot the block will be caused to travel first in a curved path about the said pivot to free the obturator from its seat, then in an approximately rectilinear path to clear the threads of the breech chamber, and then again in a curved path about the carrier pivot. Means are provided for locking the independently movable member of the swinging carrier relatively to the member that is pivoted to the gun. The angular displacement of the block may be effected by the hand-lever through the agency of a bell-crank lever pivoted to the swinging carrier, one end of the bell-crank lever engaging with a groove in the block and the other end being coupled by a connecting-rod and universal joints to a crank-arm on the hand-lever. The shot guide is adapted to automatically assume its guiding position as the breech is opened and to move away from such position as the breech is closed.—*Engineering*.

Obturators.—In order that a De Bange obturator of a gun may more effectually minimize escape of gas by the breech-block without opposing

resistance to withdrawal from the gun after firing, the centre portion of the pad is according to this invention surrounded with a steel ring "of suitable rectangular or other, section as far as strength and elasticity are concerned, whose outer diameter is somewhat less than that part of the breech opening that it enters when the breech is closed." Possibly the continuity of the elastic metal ring is interrupted; its function appears to be to hold the pad normally compressed by spring force over the whole of its circumference, so that it is a loose fit in the breech at all times that the pressure of the powder gases is not upon it.—*Engineering*.

OBTURATOR.

MAXIM SHELL FUSE. August 20, 1901.—This invention relates to delayed action fuses for use with percussion shell charged with difficultly-ignitable high explosive and such fuses are intended for fitting to charged shell that are to be stocked and kept ready with the fuses in place. The invention aims at minimizing the quantity of primary detonating mixture and provides two devices for preventing entrance of the gases of the propelling charge into the rear of the projectile, and thus safely guards



MAXIM SHELL FUZE.

against premature movement of the sliding detonator tube. On explosion of the propelling charge the violent forward motion of the projectile causes the whole of the fuse to set back, shearing one safety retaining pin and bending another, and when the shell strikes the target the bent pin shears and the fuse moves forward and is brought up against the end of its travel tube, thus causing the percussion tube to shear the pin holding it to the fuse body, and fire a disc of smokeless powder on the anvil, thus igniting the secondary detonator within the percussion tube that, bursting, then permits ignition of the tertiary detonator, conveniently pure picric acid. The travel tube is larger at its forward end, there being a sharp shoulder at the zone of division between the parts of different diameter, and this should serve to catch the rear end of the fuse when it drives forward so as to prevent it from rebounding before the explosion can take place.—*Engineering.*

SUBMARINE BOATS.

SUBMARINE TORPEDO BOATS: PAST, PRESENT AND FUTURE.*

By Lawrence Spear.

INTRODUCTORY.

As the development of the submarine, although fairly continuous, has not been entirely orderly, no sharp line can be drawn between the past and present, and during the merging period the work of contemporaries must be arbitrarily classified. That period is here taken to include the years 1885 to 1891, inclusive.

The ever increasing importance of the submarine torpedo boat in naval warfare renders it desirable that this first communication should treat the subject exhaustively on the historical and descriptive side in order to clear the ground thoroughly for future communications and discussion. However, the investigators of the problems involved have been so numerous and their work has been spread over such a long period of time as to render anything like a full treatment here impossible on account of the limitations of space. Still the process of contraction need not squeeze out much that is of value, for, as Admiral Hichborn has pointed out, a large number of inventors have neglected to read up their subject and, proceeding *de novo* have embodied in their designs ideas and appliances already thoroughly tested by previous investigators. Most of these cases of *reincarnation* may be dropped without loss of perspective, as may also the greater part of the innumerable *proposed* submarine boats, of which none were ever laid down and not half attained the dignity of real plans. In the historical review to follow then, the *proposed* boats and *reincarnations* will be omitted except in a few instances where the mention appears to be justified by the prophetic nature of the proposal or by the historical aspect of performance, and the examples selected for illustration will be limited, generally speaking, to the first of the most prominent types either in point of time or importance.

THE PAST.

Up to the Seventeenth Century man's work under water was apparently confined to experiments with crude forms of the diving bell. In 1624 Cornelius Von Drebbel, a Hollander, invented and built the first real submarine boat, oar propelled, and capable of attaining a submergence of 15 feet. No reliable data as to the dimensions and construction of this boat are available, but history tells us that she could carry twelve persons, and was rendered habitable for a considerable period of time by the use of "quintessence of air"—probably compressed air or oxygen. The credit for the first boat is frequently given to an Englishman, Wm. Bourne, but there are good reasons for believing that his invention, which antidated Von Drebbel's, really belonged to the diving bell class.

The history of the remainder of the Seventeenth Century and the greater part of the Eighteenth, shows but little real progress, for, although some of the most important principles were grasped and recorded, the practical results achieved were unimportant. During the Seventeenth Century the center of activity remained on the continent of Europe, but in the following century the problem received its principal attention in England and America, and from the latter country in 1775 came the first important solution, viz., Bushnell's boat.

* Read at the tenth general meeting of the Society of Naval Architects, New York Nov. 20, 1902.

On the intervening work it is unnecessary to touch here except to note that in 1772 the crushing of a submarine vessel by water pressure resulted in the death of its sole occupant, an Englishman named Day, who has long been heralded as the first victim of the submarine. On close inspection it appears, however, that he is not entitled to that doubtful honor, as the trap in which he met his death was not a submarine boat, but a simple diving machine, and his object under water was not to investigate or attempt submarine navigation, but to win a bet. Day being rejected, the position of first victim remained vacant until 1834, when a French inventor named Petit lost his life by asphyxiation. With one possible exception, this is the only fatality in the history of the submarine up to date. The long casualty list of the Confederate boat David is here excluded, as her misfortunes all happened while she was employed as a low free-board surface boat.

With the appearance of Bushnell's boat—the pioneer torpedo boat—submarine or surface, the art of submarine navigation took a long stride forward, and torpedo warfare made its bow as did also the screw propeller, for although the latter had been invented in England some years previous, it had never been practically applied. The information contained in the plans and explanatory legend gives a clear idea of the arangement and relation of parts, so it will only be necessary here to touch on the general features of the design which, all things considered, were well adapted to the purpose in view, viz., the attack upon ships at anchor.

The form, a sort of flattened ellipsoid with the depth exceeding the length and the length exceeding the breadth, was suitable for the strength and stability required. The balance of buoyancy and weight was effected by the water ballast system in the bottom which also served as a compensating system for weights expended or received. A vertical screw, hand operated, controlled movements in the vertical plane, indicated by a depth gauge. The horizontal movement gained by a bow propeller, was controlled by an ordinary rudder on the stern, the vessel being steered when submerged by compass. The air supply when sealed up was sufficient to sustain for half an hour the one man required to operate the vessel, and was renewed upon coming to the surface by exhaust and supply ducts with automatic operation. Lead ballast, detachable at the will of the operator, was fitted at the bottom, and was intended to be used as an anchor and emergency safety appliance. The armament consisted of a gunpowder torpedo a trifle lighter than the water it displaced. This was carried on the stern of the boat and was intended to be attached to the hull of the enemy by a vertical detachable screw operated from the interior of the submarine. The release of the mine served to start the clock-firing mechanism which was set to admit of ample time for the submarine to clear the radius of explosion.

The fact is worthy of note that before building this vessel the inventor was required to educate his generation up to the possibility of exploding gunpowder under water, and the resulting destruction of floating bodies in the immediate vicinity, so that he was practically the originator of the modern fixed mine as well as of the torpedo boat.

As to the qualities peculiar to the submarine it will be noted that efficient means were provided for varying the relation of displacement to weight, and it is possible that some reserve buoyancy might have been forced under by the vertical screw. Apparently, however, this was not the designer's intention, nor was the boat so operated, so she must be classed with the later boats designed on the principle of equality of weight and submerged displacement.

The fact that this boat never succeeded in blowing up an enemy's vessel, though she made three attempts, was due solely to bad luck. The only adequately trained operator fell sick before the opportunity

for action presented itself, and the initial attempt was made by a half-trained man, who, starting from the New York shore succeeded in reaching unobserved a 50-gun British ship lying off Governor's Island. He attempted to fix his torpedo without anchoring and failed, as at the first attempt the screw struck an iron rudder hinge pad, and in seeking a new spot he lost the ship and was surprised by daylight before he could renew the attempt. Two subsequent attempts upon British ships occurred in the Hudson River, above New York, and were also disappointments on account of the operator's failure to use his anchor. Eventually lack of encouragement and funs put a stop to the enterprise.

The work thus abandoned by Bushnell was taken up shortly afterwards by Robert Fulton, who, in 1801, after some years of preliminary work, launched his first submarine, the Nautilus, into the Seine at Paris. This vessel, an imperfect ellipsoid in form—extreme length about 21 feet, extreme beam about 6 feet—carried a hollow iron keel of a capacity equal to the reserve buoyancy in the light condition, which appears to have been very small. A double cylinder suction and force pump controlled the water ballast carried in this keel. The anchor and torpedo gear were carried in a non-water-tight bow compartment, and both were operated from the interior of the boat. The vessel was navigated from a hemispherical conning tower fitted on the bow; an ordinary stern rudder controlled the motion in the horizontal plane and a pair of horizontal rudders were fitted at the stern for control in the vertical plane. Two methods of propulsion were provided; first, a hand operated screw propeller fitted at the stern, and second, a single mast and sail so arranged as to permit of folding and stowing from the interior of the boat. The propeller originally fitted consisted of a single convolution as did Bushnell's. This was later replaced by one of several blades, apparently the first propeller of modern form put to practical use. A compass and depth gauge completed the original equipment, which was augmented later by a pipe ventilation system and a crude compressed air system for breathing purposes only. The armament consisted of a gunpowder torpedo towed by the submarine and fired by contact.

Eventually, Fulton and his crew of three men succeeded in remaining under water for a period of 4 hours and 20 minutes without ill effects. The strength of the structure limited the depth of submersion to about 25 feet. The maximum speed under sail was about two knots and submerged about three knots.

This vessel, like Bushnell's, was designed for equality of weight and submerged displacement, and as in the earlier vessel, this equality could be destroyed at will when necessary. The new features developed were the horizontal rudder, the double motive power, the conning tower and the compressed air system, all permanently established features of the best practice of to-day.

The Nautilus was subjected to thorough tests at Paris, Havre, Cherbourg and Brest, and the results of the tests were embodied in improvements until eventually she gave good promise of efficiency. However, the times were not yet ripe, and although Fulton and his projects created a furore, first in France and afterward in England, he failed to get his system adopted in either country, and eventually returned to the United States, where with Congressional aid his experimental work was continued for some years, culminating in an experimental attack on the brig Argus, in which the Argus was victorious, though at the cost of rendering herself immobile by a system of spars and netting extending to the bottom.

It is supposed that this experimental boat of Fulton's was the one employed in attacks on the British ships off New London in the War of 1812. These attacks forced the British commander to protect himself by the time honored custom of hiding behind prisoners of war. The

complaints and protestations of the relatives and friends of the latter had their desired effect, and the attacks were discontinued.

With the exception of Fulton's work, the first half of the Nineteenth Century was nearly barren of practical results, but two *proposals* warrant mention here on account of the prophetic nature of the ideas advanced. The first proposal appeared in a letter from one M. B. in the Annals of the Arts and Manufacturers in 1801, describing a submarine designed to work on the bottom. Two pairs of wheels were fitted fore and aft for this purpose, the wheels being driven by cranks, and assisted when desired by a propeller in the stern; later, about 1828, this idea was again proposed by M. Castera. The second important proposal appeared in 1823 and was published in the *Annales Maritimes.* This proposal contemplated an iron hull of large size, driven by a steam engine on the surface and a gas engine when submerged, and included a telescopic conning tower and submerged projectile tubes, surely sufficiently ambitious and scientific for the period.

The decade from 1850 to 1860 covers the work of the Bavarian, Wilhelm Bauer, who designed several submarines and built two—the Plongeur-Marin in Germany and the Diable-Marin in Russia. Aside from the iron hull, the most interesting feature of the first named vessel was the method adopted for steering and controlling in the vertical plane, the first real application of the principle of the longitudinal shift of weights. Her trials were fairly successful and she succeeded in breaking up the blockade of Kiel by the Danish fleet. On account of the collapse of the stern under water pressure, she was eventually sunk in some 60 feet of water, the inventor and his crew escaping after an imprisonment of some hours. She has recently been located and raised and is now on exhibition at the Naval School at Kiel. In Bauer's second vessel, the Diable-Marin, longitudinal shifting of weights was supplemented by horizontal rudders, and an air lock for the egress of divers was provided.

An American contemporary of Bauer's, named Phillips, who experimented on the Great Lakes with a boat of considerable size, furnished the first example of automatic control in the vertical plane. This was effected by shifting water ballast fore and aft: the control being regulated by an automatic pendulum mechanism.

The *proposals* of this decade worthy of note here are those of Marie Davy and of Tetar Van Elven. The first suggested the electric drive and the second invented an optical tube for taking surface observations while submerged, which was the pioneer of the modern periscope.

The history of the crude American submarines employed in the Civil War is well known, and, being practically devoid of technical interest, need not be recounted here, so that this short review of the submarine torpedo boats of the past may be brought to a close with a brief mention of four different types brought forward between 1860 and 1887, viz., the Plongeur of M. Brun and Bourgois, the early boats of Mr. J. P. Holland, the Nordenfeldt and the Goubet boats.

The first of these, the Plongeur, designed by Brun & Bourgois, and launched in 863, was an experiment on a large scale. Length, 136 feet; beam, 19 feet; depth, 9 feet. She was armed with a spar torpedo and propelled by compressed air, which was also for the first time in history utilized for tank service. The final adjustment between weight and buoyancy was made by altering the latter, two pistons being provided for the purpose. The means provided for control in the vertical plane were entirely inadequate for a vessel of her form and dimensions, and her behavior was exceedingly erratic; later her equalities in this respect were improved by horizontal rudders, but her performance was still so uncertain as to condemn the type.

Mr. Holland's work began with a small one-man boat, built in 1877,

which may best be described in the inventor's own words: "This boat, 14 feet 6 inches long, 3 feet wide, and 2 feet 6 inches in depth, was rectangular in external cross-section, and spindle-shaped inside, excepting in the middle section which accommodated the operator clad in a diver's suit, and also a 4-horsepower petroleum engine in a separate water-tight space. The water ballast was held between the internal and external shells. Two small tanks at the sides of the central compartment held sufficient water to neutralize the reserve buoyancy. When the operator desired to leave the boat, the reserve buoyancy was first neutralized and then the water ballast was forced from the space between the shells into the central compartment around the operator, completely filling it, after which the man-hole could be opened without difficulty. Reserve buoyancy was provided for and submersion was obtained by midship rudders."

The action of the submerging apparatus was not satisfactory, and in the next boat, length 31 feet, diameter 6 feet, displacement 17½ tons, finished in 1881, midship rudders were replaced by horizontal stern rudders. The experiments with this boat covered some three years, and the results attained demonstrated the practicability of forcing reserve buoyancy under by power from the propeller, the necessary inclination of the axis of the boat being obtained and controlled by rudder action alone. Continued development along these lines, both here and abroad, has produced the only successful and practical boats now existing.

The Nordenfeldt submarines are principally useful as examples of what to avoid, but merit some attention here, partly on account of the ambitious nature of the designs and the attention they attracted, but principally by reason of the false conclusions drawn by the inventor from his experience, which conclusions variously and ingeniously misstated have served to hamper materially the development of the submarine along proper lines.

Nordenfeldt's attention was directed to the subject by a study of the work of an Englishman named Garret, with whom he later became associated, and the distinguishing feature of Garret's second boat was adopted in all of Nordenfeldt's designs, viz., steam propulsion, both on the surface and submerged; in the latter case steam being drawn from superheated water, partly contained in the boiler used for surface work and partly in special tanks. The Nordenfeldt vessel had a length of 125 feet, a light displacement of 160 tons, and a submerged displacement of 245 tons. With 150 pounds of steam her engines indicated 1000 horsepower. Her estimated speed was 15 knots on the surface in the light condition and 5 knots submerged. In the latter condition the radius of action was expected to be 20 knots. Coal was employed as fuel, and the bunker capacity was sufficient for a radius of action in the light condition of about 1000 miles at a speed of 8 knots. By employing some of the ballast tanks as bunkers this radius could be more than doubled. She was designed to do her submerged work with about 500 pounds of reserve buoyancy, which was carried under by two steam-driven down-haul screws, one at the bow and one at the stern. The valves of the down-haul engines could be controlled by hand or automatically through a connection with a hydrostatic piston. These screws were relied upon to maintain depth and control in the vertical plane. The only remaining element of novelty was the employment for the first time of the automobile torpedoes, which in the first Nordenfeldt, were carried in exterior tubes, and in the one illustrated, in the internal tubes.

The trials of No. 4 in the light condition were satisfactory, but as a submarine boat she was almost a total failure, as the down-haul screws proved inadequate to prevent yawing, so that when under water she, like the Plongeur, took charge and alternately sought the surface and

the bottom, duplicating in this respect the behavior of the three previous vessels.

The principal seat of difficulty in all the Nordenfeldt boats was undoubtedly the large free liquid surface in the various tanks, resulting in a shifting center of gravity and a serious decrease of the designed stability. Large tank capacities were a necessary feature of Nordenfeldt's design, but the bad features thereof could have been largely reduced by subdivision. In No. 4 at least the inherent defects of the design in this respect were aggravated by mistakes in circulation, resulting in natural trim by the stern. This was corrected by an amount of fixed ballast forward, so great that certain of the ballast tanks could not be entirely filled without overrunning the permissible weights. These vessels were designed to maintain the horizontality of their longitudinal axes at all times—sinking, rising and running submerged—and most signally failed to meet expectations in that respect, as had previous boats of similar form designed on the same principle. Notwithstanding this, and neglecting the partial successes of predecessors working along different lines, Nordenfedt continued to maintain the absolute necessity of this property. His dogma in this respect was widely accepted and so tenaciously held that some of its supporters continued until a very recent date to prove theoretically to their own satisfaction the utter impossibility of accomplished and widely known facts.

The last type selected for illustration was designed by M. Goubet in 1885, and began her trials in 1889. None of the main features of the design, viz., equality of buoyancy and weight, control in the vertical plane by the automatic longitudinal shift of water ballast and a steering propeller, were really novel, but it merits attention as the most successful example of its class. The small experimental boat proved successful on trial, thanks to the care taken with details; note, for instance, the minute subdivision of the ballast tanks. That the type has not been perpetuated is doubtless due to the absence of reserve buoyancy and the unsuitability of the control system for the forms and dimensions required to meet practical conditions.

THE PRESENT.

The three leading nations in the construction of the modern submarine, are France with a total of 44, built, building or provided for; Great Britain with ten, and the United States with seven. The subject has been taken up by the other nations, but as their work is still in the experimental stage, and but little reliable data is available as to progress, it need not be considered here. Great Britain is working along American lines, and therefore the present review may be confined to the French and American boats.

The French fleet of modern submarines dates from 1886, when the then Minister of Marine, Admiral Anbe, ordered the construction of an experimental boat, the Gymnote—length 59 feet, diameter about 6 feet, displacement 30 tons—from the joint design of Dupuy de Lome and Gustave Zede. Her spindle-shaped hull was constructed of steel throughout, tank service was obtained from electrically driven pumps, and also from a compressed air system, which, in addition, furnished air for breathing purposes. A telescopic conning tower was provided for observation on the subject, and an optical tube for use below. The power installation consisted of a storage battery and a 55 H. P. motor driving a single screw. The reserve buoyancy was driven under from the propeller by inclining the axis of the boat; a pair of horizontal stern rudders being provided for that purpose.

The trials beginning in 1888 were very exhaustive, and led to the removal of the telescopic tower and a number of other alterations,

principally in the propelling and diving gear. Eventually satisfactory results were obtained at a submerged speed said to be six knots.

The Gymnote was followed by the Gustave Zede ordered in 1890—from the designs of M. Romazzotti, and launched in 1891. The design followed closely that of the original Gymnote, but on a much larger scale, the dimensions being—length 159 feet, diameter 12 feet 4 inches, submerged displacement 266 tons. The hull was of bronze throughout. She was fitted with a single screw driven by two 360 H. P. motors, fed by a storage battery of 720 Laurent Cely cells. She carried three Whitehead torpedoes and one bow tube.

The step from the Gymnote to the Zede proved too large a one and extensive trials and many alterations were necessary before the Zede gave satisfaction. Evidently the designer of the Zede did not take full advantage of the data derived from the Gymnote, as the alternations in the two cases were along the same lines. The telescopic conning tower was abandoned for a fixed one, the set of horizontal rudders at the stern was supplemented by the addition of a set amidships and a set forward, and the voltage and power were cut in two by the removal of half the cells from the battery. Reports as to her speed in her final form are conflicting, but it is probably about 8 knots. Her behavior in other respects is evidently good as is shown by her known performances in various manœuvres, noteworthy the torpedoing of the Martel in the harbor of Ajaccio during the manœuvres of 1901.

Even while the Zede was building, it was apparently realized that her dimensions were extreme for the type, and an intermediate vessel, the Morse, was ordered from the plans of M. Romazzotti. Her particulars are as follows: Length 118 feet, diameter about 8 feet 6 inches, displacement 146 tons, horsepower 350, armament one bow tube and two side carriers of the Drzewiecki type. The design follows very closely that of the improved Zede. Her construction was long delayed on account of proposed improvements, and she was not launched until 1899. On trial she developed a speed of 12.3 knots on the surface and about 8 submerged. Excellent results for her type.

While the Zede and Morse were in hand a different type known as the *submersible* and represented by the Narval was under development. This type is fitted with a separate power installation for propulsion on the surface and for recharging batteries, thus rendering the boat independent of a base so far as power is concerned, greatly increasing the radius of action and diminishing the risk of total disability.

In 1896 the Minister of Marine invited designs for a submarine not exceeding 200 tons displacement, which should carry two torpedoes ready for launching, and have a radius of action on the surface of 100 miles at 12 knots, submerged of 10 miles at 8 knots. Of the 28 designs submitted in accordance with this call, three were awarded prizes, though the first prize of 10,000 francs was withheld. From among these designs, that of M. Laubeuf was later selected for development, and finally took substance in the Narval, launched in 1899. Her particulars are: Length, 111 feet 6 inches; beam, 12 feet 4 inches; displacement, light, 106 tons; submerged, 200 tons. A water-tube boiler burning petroleum supplies steam for a 250 H. P. triple-expansion engine used for surface propulsion, and for charging air flasks and recharging the storage battery. As to the details of the electric installation, little is known except that two motors are employed. The armament consists of four torpedoes in Drzewiecki carriers. The speeds and radii of action are reported to be as follows: Maximum surface speed, 12 knots; radius at that speed, 242 miles; radius at 8 knots, 625 miles; maximum submerged speed, 8 knots; radius at that speed, 25 miles; radius at 5 knots, 70 miles. As to submarine qualities, the design of the Narval follows the Morse, and aside from the double power installation the only item of particular interest is

the construction adopted for the hull which is a development of the system employed in the first Holland boat, viz., complete double bottoms or rather double skins, the enclosed space being entirely full of water when submerged. The French authorities appear to be well satisfied with the Narval, except as to the length of time necessary to pass from the light to the diving condition, which is excessive. In later boats of her class that time has been reduced somewhat—but the fault has not been wholly eradicated.

The exact composition of the total authorized fleet of 44 cannot now be told, as the details of a number of the boats authorized have not yet been settled, and the experience with the vessels in hand is certain to alter the program, probably in the direction of increasing the "*submersibles*" at the expense of the "*submarines*" proper. However, following the Morse, six submarines proper have been launched— the Francais and Algerien—almost identical with the Morse, and the Farfadet, Gnome, Korrigan and Lutin, somewhat larger—length 135 feet 8 inches, diameter 9 feet 6 inches, displacement 185 tons, surface speed 12¼ knots, submerged speed 9 knots, and twenty smaller ones of the Perle class have been laid down. The particulars of these are: Length 77 feet, diameter 7 feet 6 inches, displacement 70 tons, surface speed 8 knots, submerged speed 6 knots. Of the "*submersibles*" four have been launched and completed in addition to the type boat—the Narval—these are the Sirene, Triton, Espadon, and Silure—identical in general design with the Narval, but improved as to details. Of the "*submersibles*" now in hand or projected, but little is known, except that in at least one of them an explosive oil engine is to be substituted for the steam engine and boiler.

The modern American submarines all belong in the "*submersible*" class, and date from 1895, when the Navy Department, after competition, selected a Holland design and entered into a contract with the Holland Torpedo-Boat Company for the original Plunger. The history of that vessel is so well known that it will only be necessary here to recall to mind her principal features, which were, length 85 feet, diameter 11 feet 6 inches, light displacement 140 tons, submerged displacement 165 tons. A petroleum burning boiler furnished about 1500 H. P. which was divided between two screws. A storage battery and motor were provided for submerged work. She was designed for 15 knots on the surface and 8 knots submerged, and was fitted with down-haul screws to assist her horizontal rudders. This combination was never put to a practical test, as the enormous steam power installed in a very limited space rendered her practically uninhabitable on account of the high temperature developed. Her construction was eventually abandoned and a contract was entered into for a new Plunger of a truly modern type.

While the old Plunger was under construction for the Government the same company brought out privately the Holland, length 53 feet 10 inches, diameter 10 feet 3 inches, submerged displacement 75 tons. She was propelled on the surface by an Otto gasoline engine of 50 H. P., and when submerged by a 50 H. P. electric motor fed by a storage battery of 60 cells with a capacity of 1500 ampere hours at a four-hour rate of discharge. A double commutator was fitted on this motor so that 150 H. P. could be safely developed. Her final armament consisted of one bow torpedo tube, one bow pneumatic dynamite gun and three short Whitehead torpedoes. Her surface speeds are 6 knots under the gasoline engine, and about 8 knots under the motor, and her submerged speed is 5½ knots under the motor. A single pair of horizontal rudders at the stern, operated by air engines, serve to control her in the vertical plane. These engines as well as the vertical rudder engines were arranged for automatic operation when desired, but experience has proven the entire feasibility of brain control, and the automatic attachments are seldom, if ever, used. Air compressors and reservoirs furnish

air for the steering and diving engines, tank and torpedo service, as well as for breathing purposes. The reserve buoyancy resides in the conning tower, which was originally telescopic, but is now fixed.

In 1901 the same company brought out the Fulton, built as a trial vessel for the seven Government boats Adder, Moccasin, Porpoise, Shark, Grampus, Pike and Plunger, for which contracts were entered into in 1900. The general features of the Holland's design have been followed closely in her, but she is larger, roomier, faster, and is simplified and improved as to details. Her particulars are as follows: Length 63 feet 4 inches, diameter 11 feet 9 inches, total displacement 122½ tons. On the surface she is propelled by a 160 H. P. 4-cylinder Otto gasoline engine, and when submerged by a 70 H. P. electric motor fed by a storage battery of 60 cells, with a capacity of 1900 ampere hours at a four-hour rate of discharge, average potential 110 volts. Pneumatic engines for the steering and diving rudders, the latter with both hand and automatic control, were originally provided. These have since been removed and a simple and efficient hand gear has been substituted therefor. She carries one bow tube and five short Whitehead torpedoes with water compensation. The engine and motor are so geared up that either can be used to operate the auxiliary machinery which comprises an air compressor and a powerful rotary pump. The compressed air capacity for torpedo and tank service is 40 cubic feet at 2000 pounds pressure, suitably reduced for various uses. The change in the relative power of the engine and motor is a large step in advance over the original Holland, as it enables fair speed on the surface, viz., 6 knots to be made while charging batteries. Her speed and radii of action are as follows: In the light condition under the gasoline engine 400 knots at a speed of 8½ knots, and 560 knots at a speed of 6 knots. In the semi-awash condition under the gasoline engine 340 knots at a speed of 7 knots. In the submerged condition under the electric motor 21 knots at a speed of 7 knots, and 35 knots at a speed of 5½ knots, and ready to dive with the conning tower only showing she has a maximum radius of 100 knots at a speed of 3 knots.

In November, 1901, this vessel with a full crew was submerged at her dock for a period of 15 hours. During this time the only fresh air supply was that furnished by a leaky valve, which allowed the pressure in a flask of 5 cubic feet capacity to run down from 2000 to 1900 pounds per square inch. When the vessel was opened up the air was still reasonably sweet and pure and the crew suffered no unpleasant effects. Her habitability under service conditions was tested last spring by a voyage under her own power from New Suffolk, Long Island, to the Delaware Breakwater. The first leg of the journey, from New Suffolk to New York, was made through Long Island Sound at an average speed slightly exceeding eight knots. The second leg, from New York to the Delaware capes, was made under half power at an average speed of six knots, except for an hour and a quarter during the journey which was occupied by submerged runs. Her ultimate destination on this trip was Chesapeake Bay, but the voyage was brought to an abrupt termination at the Delaware Breakwater by an explosion of battery gas, which had been allowed to accumulate underneath the battery deck. The presence of the gas was due to deterioration of the battery caused by accidental submersion in salt water.

The Government boats Adder, Moccasin, Porpoise, Shark, Grampus and Pike are practically duplicates of the Fulton. The Plunger is the same in dimensions and general arrangement, but differs in some details, the most important of which is the armament, where the three long Whitehead torpedoes have been substituted for five short ones.

Before closing the descriptive portion of this paper, mention should be made of another modern American submarine, viz., the Argonaut

brought out by Mr. Simon Lake. The Argonaut herself does not fall within the scope of this paper, as she was designed for commercial purposes, and is not adopted for torpedo boat work. She is entitled to mention here, however, partly on account of her interesting features, but principally on account of the fact that her inventor is building an experimental boat embodying her principal features, but intended also for torpedo boat work. The approximate dimensions of the Argonaut are as follows: Length 36 feet, diameter 9 feet, displacement submerged 60 tons. Her under-water work is confined altogether to operations on the bottom. A 30 H. P. gasoline engine propels her on the surface by a single screw, and on the bottom by this screw or a pair of driving wheels, or both, as desired. The guide wheel serves as a rudder both on the surface and submerged. In common with other submarines, she has a water ballast, compressed air and electric light system, which present no novel features except as to the bow searchlight for examination of the bottom. She is submerged by down-haul weights of a thousand pounds, attached to suitable windlass mechanism by which any amount of reserve buoyancy not exceeding the down-haul weights, may be hauled under. The water ballast system enables the relation between the down-haul weights and the reserve buoyancy to be altered at will, so that the virtual weight on the bottom may be controlled. Communication with the surface is always retained by two hollow masts which form ducts for the introduction of air and the expulsion of the products of combustion. As the vessel was intended for submarine surveying, wrecking, etc., a diver's compartment and air lock is made a prominent feature of the design.

The success of this vessel in her field has led the inventor to place on the stocks a new and larger vessel in which it is intended to combine the bottom working features of the Argonaut with the necessary operation between the surface and the bottom. This vessel is to be fitted up with a storage battery and motor, so that communication with the surface need not be retained. The apparatus for controlling between the surface and bottom will consist of inclining planes fore and aft, termed by the inventor "hydroplanes." The design contemplates great stability, the intention being to manœuvre on an even keel, the hydroplanes serving simply to give a vertical thrust, but no turning moment about the center of gravity. At the time of writing, this vessel has not been launched, so no data are available as to the efficiency of the design, except in so far as it duplicates the Argonaut.

THE FUTURE.

Before attempting to foreshadow the future of submarine torpedo boat construction, it will be desirable to examine in a little more detail the more important features of the modern types, as such examination, though necessarily brief, should enable us to judge roughly both as to the propriety and possibility of future development along the present lines.

Confining ourselves at present to the *submersible* type, we note that the French and American *designs*, though independently worked out, are identical as to general principles and close to each other in the main features of design, the difference in the aims of the designers, being taken into account. The distinguishing features as *submarines* are, *first*, reserve buoyancy, and *second*, control in the vertical plane by *rudder action only*.

The presence of reserve buoyancy undoubtedly increases the difficulty of securing complete and satisfactory control in the vertical plane, as no matter where located it introduces an upward force which requires balancing, and it may, in addition, introduce a turning moment about the center of gravity which also requires balancing. Its advantages, how-

ever, entirely justify its presence, since it not only serves as an instantly available element of safety in an emergency, but also permits the submarine to maintain the awash condition whether underway or not, without change of ballast or direct expenditure of power. In this condition, ready to dive instantly, presenting only the conning tower as a target, and herself commanding a complete view of the horizon, the submarine will do a great part of her work, even in the event of the perfection of observation apparatus for use when submerged. It is safe to conclude then that this feature has been permanently adopted.

The second characteristic, viz., control in the vertical plane by *rudder* action only, is also fully justified by tactical and construction reasons. It is obvious that a change in depth can be effected in the least time and by the least expenditure of energy, if the vessel be moved in the direction of least resistance; in other words, if she be *steered* up and down *inclines* by altering the angle of her longitudinal axis to the horizon. In order to be effective, the turning moment used must be of considerable magnitude and under the most sensitive control, conditions best met by horizontal rudders, which have also the advantages of simplicity and economy of space, weight and power. Other things being equal the rapidity with which a submarine can rise for observation and dive again is a direct measure of efficiency, since its chance of escape from observation or projectiles is in inverse proportion to the period of exposure. As pointed out below, a loss in this quality may be justified when balanced by a corresponding gain in the equally important tactical feature of speed, but in no other way, hence it may fairly be concluded that this feature also has come to stay.

The correspondence between the French and American designs extends also in a general way to the most important construction feature, viz., the power plant. For submerged work both have adopted the electric drive, and for surface work and recharging batteries, etc., both go back to the hydrocarbons, the American using the light oil gasoline, with an explosive engine, while the French employ a heavier oil, petroleum, and transform its energy into steam instead of using it directly in an explosive engine.

From a purely theoretical point of view, the American system is better adapted to the purpose, involving as it does only one variable weight, viz., fuel, against two for the other, viz., fuel and feed water. This leads directly to simple and rapid compensating arrangements tending towards a reduction in the time necessary to pass from a cruising to the fighting condition, a tendency still further helped by the absence of the high temperature accompanying steam propulsion, as well as the slow working apparatus for the escape of the products of combustion. In general simplicity and economy of space the American system offers additional advantages. On the score of safety, the advantage, if any, lies at present with the French. A less volatile oil is used in the first instance, and it is probably less difficult to secure the complete expulsion of the products of combustion. The advantage, however, is not important as the danger element in either case is well within permissible limits and will unboubtedly be still further reduced in future boats employing the American system by the use of heavier oils and the perfection of the apparatus for disposing of the products of combustion. The principal advantage of steam propulsion lies in the fact that the designer can avail himself of very complete data based on experience, whereas since the marine oil engine of the power now required is practically new in the field, the designer is hampered by lack of reliable data. Ultimately, however, the oil engine will probably displace the steam engine, since the development of the former offers the possibility of a single motive power for all conditions, which will be reasonably efficient in the submerged condition. Modern chemistry is already in a fair way to provide the materials for

supplying the necessary oxygen in such form as to meet the conditions imposed in a submarine. In the meantime the growing field of the oil engine, both afloat and ashore, will supply the experience necessary for the development of the largest powers apt to be used in the submarine.

The remaining important feature common to both designs is the employment of the electric drive for submerged work. The storage battery and motor are admirable in some respects, but exceedingly inadequate in others, the principal objection being the well known one of excessive weight and space in proportion to the power developed. When it is stated that a weight of 370 pounds per horsepower hour is a fair average for a suitable installation, it is readily seen that there is much room for improvement. Another disadvantage of the battery lies in the care and attention necessary for its safe operation after sensible deterioration has set in. The difficulty which takes the shape of abnormal behavior with respect to "gassing" may, under certain conditions, result in an explosion such as took place on the Fulton last spring and more recently on the Holland. Fortunately, however, this condition is not inevitable, and is susceptible of control when it does occur.

There is no particular quarrel with the motor, except as to the difficulty in fitting it with a suitable propeller, and the battery bids fair to develop faster in the future than in the past, on account of the increasing demand for a light, compact battery for automobile use. Its continued use may thus be expected until the appearance, in practical form, of a development of a heat engine similar to that hinted at above.

The principal difference between the French and American designs lies in the choice made of dimensions and proportions which appears to be the direct result of different ideas as to the relative values of speed and manœuvring qualities. To attain the high surface speed desired, the French designers have been forced to adopt a considerable displacement, great length in proportion to beam, the double hull with large tank capacity, and incidently the steam engine and multiple rudders. As compared with the Holland boats, the increase in surface speed is gained by a sacrifice of efficiency in three directions: First, as to simplicity; second, as to the length of time necessary to pass from a cruising to the diving condition, and, third, as to the necessary period of exposure for conning tower observations. No exact data are available as to the minimum observation period required by the French boats, but their extensive use of the periscope indicates a relative inferiority in this respect. In shallow water at least this result would naturally follow from the dimensions and form adopted, as it is probable that the rudders are then used to produce not only a turning moment but also a vertical thrust.

While the limit of surface speed for a given displacement has not yet been reached for either type, further material advances are most apt to be made by further increases in development. The limit to this process is not set by construction reasons, but by the probable use of the type, which for any one country is fixed by its geographical location and the nature of its coast and harbors. For instance, a *submersible* of the Narval type and dimensions, is for France not only a *defensive* but an *offensive* weapon, and the partial sacrifice of submarine qualities in the design is warranted by the possibilities for offensive use. The same boat transferred to America would become purely *defensive* and would not be so well adapted to the conditions here as is the American type. It is probable then that in countries situated like France, where the possible enemy possesses large ports and arsenals within easy striking distance, the *submersible* will eventually be increased in displacement to perhaps 300 tons, in order to obtain a vessel which shall be seaworthy in a large sense, habitable for considerable periods, self-supporting and capable of a fairly high sustained sea speed. Such a boat would be first

and foremost a weapon of *offense* and only incidentally a weapon of *defense*, in which field its place would be taken by several smaller units. Whether these units should be of the *submersible* or pure *submarine* type depends upon the extent of the coast, the number of harbors, the internal water-ways and the condition of the fixed defenses. As noted above, France has adopted for this purpose the *submarine* of the Perle type, a course which is probably justified by the small number of her harbors and her highly organized fixed defenses.

Turning now to the United States, her location with respect to possible enemies is such that there is no immediate prospect of the development of the large *submersible* into an *offensive* weapon, still the extent of her coasts, the number of her harbors, and the rudimentary character of her fixed defenses, renders this type preferable to the pure *submarine* for *defensive* purposes. The development of the best all-round boat to meet the conditions is likely here also to lead to some increase in total displacement, which, eventually however, will probably not exceed 200 tons. As compared with the larger *offensive submersible*, such a vessel would be less seaworthy and would have less surface speed, better manœuvring qualities and greater submerged endurance. The pure *submarine* would thus at first glance appear to be an undesirable type for the conditions prevailing in the United States, but this is only true so long as the sole aim is torpedo work. As a matter of fact, however, the usefulness of the submarine is not confined to this one function; as it affords to-day the best known means for the destruction of mine fields and cables, and the reconnoitering of fortified harbors. The objective being far removed, it is essential that the dimensions and weight of this type of vessel be kept at the lowest limit in order to admit of transportation by battleships, armored cruisers, and the larger class of scouts. In such a vessel some armament would be desirable for attack upon stationary shipping, dry docks, etc., but this feature should be subordinated to the features necessary for efficient bottom work. By taking full advantage of the latest developments in diving apparatus, all the essential features, including efficient signalling apparatus, could to-day be combined in a maximum length of 35 feet and a maximum displacement of 25 tons. This appears to be the only possible guise in which the pure *submarine* may play an *offensive* rôle, and even here, in the author's opinion, means for recharging batteries are desirable and justifiable, as scout work might require a considerable radius of action.

To sum up, it appears that the submarine boats of the near future will naturally divide themselves into four types and two main groups, to conform to the different conditions in the different maritime countries. Group 1 would be suitable for many of the European countries, and would include the large *offensive submersible*, self-supporting, with auxiliary bottom working features, and the small *defensive submarine* for torpedo work only. Group 2, suitable for the United States and similarly situated countries, would include the small *offensive* ground working *submarine* or *submersible* (with auxiliary armament) and the medium sized *defensive submersible* for torpedo work only. It appears, further, that the *submarine* qualities of the modern boats are based on sound principles, and that the future development of the four different types within the limiting displacements of each must be along the present lines, and in the direction of improvement in the tactical qualities of speed and practical radius of action. As pointed out above, improvements in these respects are largely dependent upon the general improvement of the power installations, and as compared with the corresponding feature in the main objective, the battleship, the improvement in the submarine bids fair to be the more rapid.

In conclusion, it is proper to state that the author, cannot vouch for the accuracy of the data given above with regard to the modern French

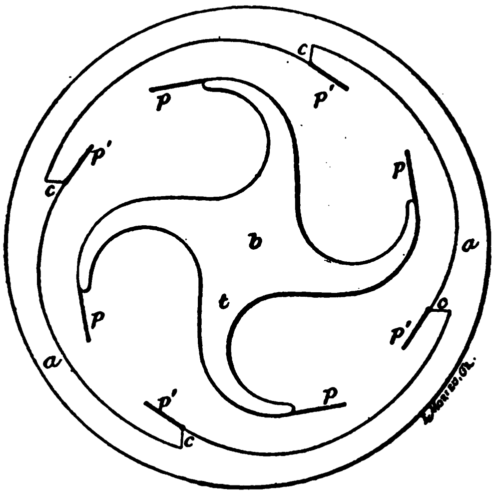
boats, although it is believed to be substantially correct. All available sources have been freely drawn on for the data contained in the historical review, but the author is especially indebted in that respect to the admirable work of Lieut. Delpeuel of the French Navy, entitled "La Navigation Sous-Marine a travers les Siecles." No apology is offered for the lack of the detailed data so desirable in a communication to a technical society as, for obvious business reasons, it has been necessary to exclude the consideration or description of details from this paper.

WIRELESS TELEGRAPHY.

MARCONI'S "CARLO ALBERTO" EXPERIMENTS.

By Emile Guarini, Brussels, Belgium.

The daily papers and technical journals all over the world have published the results of Marconi's recent experiments on board the ship



PLAN VIEW OF THE INTERRUPTER.

Carlo Alberto, results obtained at first during his voyage to Cronstadt and afterward in the Mediterranean, during which he communicated with the transmitting station at Cape Lizard over the extraordinary distance of 1600 miles (French) of which a great portion was over dry land. There are many who are still incredulous, not so much because of the seeming impossibility of such a feat, but rather on account of the contradictory and exaggerated reports furnished by the papers, which at the same time attributed to Marconi conversations and plans in which the illustrious inventor perhaps never indulged. In this manner much was made of the *absolute secrecy* of the communications resulting from his new system of attuning the receivers; also of the possibility of sending messages across Switzerland and the Alps; one journal even maintained that Marconi could without difficulty transmit his messages overland without regard to distance. It may be noted in passing, that, theoretically considered, messages are possible from any given point to any desired point upon the earth's surface, and provided sufficient im-

pulse can be given to the electric waves, it is indeed practicable to send them through the earth itself. Archimedes once said: "Give me a fulcrum and a lever long enough and I will lift the earth." The problem to solve in this particular is whether or not such communications are practical, that is, whethei the extreme cost of operating stations producing such high electric energy would not exceed the commercial revenue.

Demonstration has proven that it requires 40 horsepower to communicate easily, during the day, with a station 1000 kilometers distant. To send, therefore, a message 20,000 kilometers (about half around the globe, the complete tour not being necessary), and admitting that the energy required varies as the square of the distance a force of $20^2 \times 40 =$ 16,000 horsepower would be needed. This entails a by no means insignificant plant. Would not a line of intermediate automatic stations be even more economical? In this latter case the energy would increase instead of diminishing with the distance. Doubtless the general public will be glad to receive positive and reliable information concerning Marconi's above mentioned experiments and we cannot do better than give here a resumé of the official report made to the Italian Naval Department by Marquis Solari, who besides being the lieutenant commander of the vessel and a co-worker with Marconi in these trials, is a distinguished officer of whose valor and capabilities we have had personal demonstration.

Last June the ship Carlo Alberto of the Royal Italian Navy returned to England equipped with one of Marconi's old-style radiotelegraphic outfits, which had already withstood several journeys by rail and been several times shipped and transshipped without any special care. On this account the installation and regulating of the apparatus consumed several days' time and required much patience and care. Being thus supplied, the Carlo Alberto, as soon as she arrived in English waters, placed herself in radiotelegraphic communication with the station at the Lizard in Cornwall where Marconi himself was, and with his aid at once took the necessary steps to set up a more sensitive and perfect appliance. On the 26th of October, Marconi came aboard bringing with him instead of the usual coherer, a magnetic detector. A supplementary mast about 50 feet high was erected in the forward part of the ship. Between this and the ship's foremast was suspended the antennæ carrying four cables, the antennæ being inclined in such a manner as to form a certain angle, and reflect, so to speak, directly into the operator's hut on the deck.

The points of suspension of this combination of spreaders and cables were insulated by chains of porcelain, and the cable entrance to the operating room was through an ebonite tube of suitable length and diameter. Every possible precaution was taken to insure perfect grounding; cables were attached to several parts of the machines as well as to the keel of the ship. An extra powerful transmitting station would require an especial outfit of implements which would be very cumbersome not to say expensive; accordingly the Carlo Alberto was only fitted out as a receiving station for wireless messages. Two ordinary coherer receivers furnished with transformers attuned to the station at Cape Lizard and three magnetic detectors were installed. The coherers were as usual connected with the Morse receivers while the magnetic detectors actuated the telephones.

The station receiver on board the Carlo Alberto was the same with which Marconi, in February last accomplished such remarkable feats on the Philadelphia.

The transmitting antennæ at the Lizard resembled those which Marconi had installed at Cape Breton. Four wooden masts about 220 feet high were erected at the corners of a quadrilateral whose sides measured

about 190 feet. The tops of the masts were connected by heavy steel cables, from which hung 400 copper conductors, 100 on each side of the quadrilateral, and placed a trifle less than two feet apart. All these conductors are united into one cable at about 13 feet from the ground before they enter the operating room. This construction presents the appearance of an inverted pyramid. The potential with which the aerial conductors were charged during the transmission, was such that sparks of 0.30 c. could be obtained between their summit and a conductor placed on the ground. This is an enormous potential if one takes into consideration the stupendous power necessary to charge them.

Marconi himself arranged for all the experiments, fixed the hours of work both by day and by night, and determined upon the signals to be sent; he then embarked at Dover on the Carlo Alberto on July 7. At a distance of 500 French miles from the Lizard, and of which six-tenths of the flight was over dry land, the experiments began. No sooner had the attuning been effected to a certain point than the telephones connected with the magnetic detector gave forth the first sounds to come from Cornwall. "Because of the imperfect attuning," said the Marquis, "the first sounds from the telephones were feeble and indistinct, and also because of the anti-electrical effects of the sun's rays or solar light." On the following day messages were received with fewer obstructions and the coherers actuated the Morse receivers sufficiently to obtain a register or copy of the messages. The sending of messages from Cape Lizard being now suspended for the day, the Carlo Alberto became a transmitting as well as a receiving station and as such entered into communication with the English Marconi telegraph stations at North Foreland, Trinton, etc., through the courtesy of which he sent several dispatches to different points in Europe, notably one to the Italian Minister of Marine at Rome. During the night of July 7, and owing to the more favorable influence of darkness, the Carlo Alberto received additional signals from the Lizard now 900 kilometers away, both on the coherer receiver and on the receiver connected with the magnetic detector. During a trial, at a distance of 1000 kilometers from the Lizard, which was made at noon of July 9, the coherer failed to catch any of the signals while the magnetic detector caught the rhythmic sounds of several SS. The following night and during the nights of the 11th and 12th of July, at first dispatches and then signals were received by Marconi at Cronstadt across the Scandinavian peninsula. At Cronstadt the signals (SS) were indistinct, because, it is said, fresh water makes a poor grounder. On July 23, the Carlo Alberto steamed for Kiel, and just at this time the reception of the signals had been much improved, either by effecting a more perfect attuning of the instruments or by increasing to 50 the number of the conductors suspended from the receiving antennæ. Thanks to these artifices several SS. were distinctly received from Cornwall. On the return voyage the facility of receiving was improved still more, but a series of inexplicable phenomena occurred, the most notable of which was the sudden and total cessation of all signals. At 1 o'clock, on July 23, the Carlo Alberto, being then in the Baltic, received very distinctly several signals from Cape Lizard, over 2000 kilometers away. At 2 o'clock atmospheric disturbances interfered with the working of the coherer to such a degree as to render it useless for the time being, while the precautionary measures which had been taken prevented any interference with the working of the magnetic detector. An incomprehensible phenomenon now took place. At first the receiving became somewhat imperfect and at length it became impossible to get any response whatever. In vain were made all possible attempts to ameliorate the conditions, all efforts at receiving and attuning; in vain were the antennæ of the Carlo Alberto placed parallel with those at Cape Lizard by causing the ship to take up the proper position. The failure of this

last resort proved that even for Marconi the manner in which the electrical waves or impulses proceed is still an enigma. Discouraged by failure after failure, and having about abandoned all further efforts to open up the interrupted communication, all hands were astonished when suddenly the signals began to come in again, clear and distinct. An attempt has been made to explain this phenomenon by the difference in the velocity of the electric rays when traveling over the land or over the water. Like Marconi and Lieut. Solari, we too are loath to accept this explanation.

In the roads at Kiel on July 24 many dispatches were clearly received on the Morse. Previous care having been taken to guard against the danger, messages were successfully and satisfactorily received during the raging of a violent storm. Experiments were made with Castelli's carbon and mercury coherer, concerning which so much comment has appeared in the technical press of England, Germany and America. It would seem, however, that these experiments were not satisfying. For several days thereafter excellent and uninterrupted communication was enjoyed with the station at Cape Lizard as well as with the other Marconi stations on the eastern coast of England. August 2 saw the Carlo Alberto anchored in the harbor of Plymouth. The twenty days ensuing were occupied with the necessary preparations for the radiotelegraphic campaign then to be undertaken in the Mediterranean. For this purpose the receiving antennæ were somewhat modified, being composed of 50 conductors placed at an elevation of 50 meters (about 160 feet) above the bridge. Everything being in readiness, on the 25th of August Marconi boarded the Carlo Alberto at Mullion and set sail for Ferrol, Spain. Both during the voyage and while in the port of Ferrol messages were received without serious interruption. Ferrol was left on the 30th of same month for Cadiz. During the course of this voyage it was possible to ascertain that the maximum distance over which a communication could surely be made, by day, with the power then available, viz., 40 horsepower, and the sensibility of the receiver the greatest possible (discounting the atmospheric-electric perturbations) was about 1000 kilometers. On the night of the 30th and 31st of August the effect of the interposition of the Spanish mainland was observed. In spite of this, the receiving coherer continued to work well, and all the news received by the wireless system was communicated to the officers and crew, who were much delighted thereby. During the night of the 3rd and 4th of September, the Carlo Alberto entered the deepest inlet in the roads of Gibraltar, where, in spite of the 1500 kilometers of distance and the obstructions offered by the most rugged of land formations, several dispatches were received from Poldhu (Cape Lizard), among others the one relating to the health of the Czarina.

At this point in the official report there is a vague passage, which does not say with positiveness whether certain dispatches originating in England were received at Cagliari or at Spezzia. The report continues: "The successive days of the 4th, 5th, and 6th of September saw a new triumph for the imposing invention of Marconi most certainly demonstrated, viz., the fact that from the beginning to the end no obstacle interfered with the satisfactory working of his system of radiotelegraphy, while conducting experiments in a closed sea, a sea closed by such extensive mountain ranges as the Mediterranean, and that the radiotelegrams arrived from Poldhu constantly and surely at the receiver on board the Carlo Alberto. As proof of this we have the Morse ribbons regularly signed by Rear-Admiral Mirabello, who thus personally attests the truth of these experiments."

We give below the conclusions drawn from the experiments by Marquis Solari:

1. To begin with, there is no limit to the distance which may be cov-

ered by the electric waves on the surface of the globe, if the energy employed in the transmission is proportionate to the distance to be traversed.

2. Dry land interposing between a transmitting and a receiving station does not interrupt the communication.

3. Solar light diminishes the radius of action of the electric waves, and an increase of energy, for the transmission during the day, over that necessary for night work is therefore required; the obstructive influence of atmospheric electrical discharges also compels the use of less sensitive receivers, if they are not to be affected, and a corresponding increase in the energy of the transmitters.

4. The magnetic detector has by these experiments shown itself far superior to every coherer, because it needs no regulating; because of its absolute constancy in operation as well as for its practicability and the extreme sensitiveness of the system.

5. The Marconi Wireless Telegraphy has by virtue of these latter improvements entered upon the field of the grandest of the applied sciences, either commercially or for military purposes, without limit of distance.

Several objections thrust themselves upon the mind on reading these sweeping conclusions of Lieut. Solari, conclusions which, we fear, derive no small amount of enthusiasm, justifiable enthusiasm for that matter, from the part that the valiant officer himself took in the experiments. We are only too willing to heartily agree with all the above conclusions, although upon the item of distance we are inclined to the transmission by intermediate relay stations; moreover we feel that, the mere fact that a communication may have been held between two persons, one on the coast, the other 1000 or 2000 kilometers at sea, does not prove that a like communication would be possible with the same expenditure of energy, the same antennæ and the same apparatus over a distance of 500 kilometers on the land. To the support of this doubting we desire to bring but one of many arguments: If the sea has an acknowledged directing influence over the electric waves, how is it possible to affirm that one may hold wireless intercourse over land without regard to distance? The electric waves may follow the sea or traverse the contours of continents, but that does not say that the transmission of a signal is equally as easy and possible over similar distances between two stations situated in the interior as if they were upon the sea. Concerning the dis-electritation of the transmitting antennæ, said to be due to the sun's rays or solar light, it appears to us that this difficulty might be readily overcome by covering the transmitter with an opaque body. It has several times been upon our minds to remark that certain insulating materials as caoutchouc and the like which surround the antennæ produce a diminution in the effects due certainly to absorption. (Note the experiments on the Righi.) As for the *magnetic detector*, the most explicit description and explanation is to be desired. We voluntarily admit that this instrument is surer than the coherer, which is not a very difficult matter, but is it more sensitive also? Can one conceive how little energy is needed to actuate coherers, as sensitive as those of Blondel for example?

CONCLUSION.

That the commercial future of wireless telegraphy is assured is indisputable; it is also indisputable, we think, that wireless telegraphy itself is discussed.—From *Scientific American Supplement.*

BOOK NOTICES.

"Modern Seamanship." By Austin M. Knight, Commander, U. S. Navy.

D. Van Nostrand & Co. announce a new edition of Knight's Modern Seamanship, the two previous editions having been exhausted. It seems appropriate at this time that the Institute should take somewhat more extended note of this important work than was done when it originally appeared.

The great difference between this and other works on seamanship is that in all former works, even those which have been revised with a view to meeting modern needs and in which some importance is attributed to steamship seamanship, square-yard seamanship still remains distinctive.

In Knight we find that steamship seamanship is distinctive and pre-eminent, although square-yard seamanship is still recognized sufficiently to satisfy the majority even of those whose hearts are still with the old square-riggers. But to young and active minds, intent upon mastering the details of modern seamanship, Knight's work will commend itself as discussing every feature from the standpoint of the necessities of the modern steamship, whether it be battleship or ocean liner, cruiser or torpedo-boat destroyer.

The book is contained in 27 chapters, as follows:

Chapter I —The Hull and Fittings of a Ship.
Chapter II —Rope-Knotting and Splicing.
Chapter III —Spars and Standing Rigging.
Chapter IV —Sails and Running Gear.
Chapter V —Mechanical Appliances on Shipboard.
Chapter VI —Blocks and Tackles.
Chapter VII —Handling Heavy Weights.
Chapter VIII —The Compass, Log, and Lead.
Chapter IX —Boats.
Chapter X —Handling Boats in a Surf.
Chapter XI —Ground Tackle.
Chapter XII —Carrying Out Anchors.
Chapter XIII —The Steering of Steamers.
Chapter XIV —The Rules of the Road.
Chapter XV —Manœuvering to Avoid Collision.
Chapter XVI —Piloting.
Chapter XVII —Handling a Steamer Alongside a Dock.
Chapter XVIII —Placing a Ship in Drydock.
Chapter XIX —Weather and the Laws of Storms.
Chapter XX —Handling Steamers in Heavy Weather.

Chapter XXI —Towing.
Chapter XXII —Rescuing the Crew of a Wreck.
Chapter XXIII —Man Overboard.
Chapter XXIV —Stranding.
Chapter XXV —Making and Taking in Sail.
Chapter XXVI —Manœuvring Under Sail.
Chapter XXVII—Getting Underway and Coming to Anchor Under Sail.

Although, as before remarked, every subject here discussed is treated from the standpoint of modern necessities, there is manifest throughout a knowledge and appreciation of the practice of former days. It is interesting to remember that it is this former day practice which has developed all of the best seamen of the present—Knight among them.

In the preparation of several of his chapters, Commander Knight was assisted by the advice of some forty prominent shipmasters of the merchant marine, who, in response to a request by him, contributed their views upon the following subjects:

I—Taking a disabled vessel in tow in bad weather.
II—Rescuing the crew of a wreck in bad weather.
III—Rescuing a man overboard.
IV—Lying to in a gale.
V—The stowage and handling of boats.
VI—Manœuvring single screw and twin screw vessels.
VII—Floating a stranded vessel.
VIII—Handling steamers around a dock.

It is not possible to over-estimate the value of the experience of these forty shipmasters, and therefore of this book, to those who follow the sea. The results of this experience are embodied in the chapters on "Handling Steamers in Heavy Weather," "Handling Steamers Alongside a Dock," "Towing," and "Rescuing the Crew of a Wreck." It has doubtless also colored the author's views in many other parts of the work.

It may safely be stated that the subjects above enumerated have never before been properly treated in any publication, and it is not an exaggeration to say that their treatment here leaves nothing to desire.

At the present time officers young in the service, whose naval experience has been limited to watch-standing on battleships, cruisers or gunboats, are being ordered to command torpedo-boats, tugs and tenders, and these frail craft have received many injuries while being handled around docks through the pardonable inexperience of such officers. To officers thrust suddenly into such positions, Knight's Chapter on "Handling Steamers Alongside a Dock" should be invaluable. In this chapter the circumstances of various cases are fully discussed and illustrated by plates, the whole producing in each instance a clear and effective picture.

Another chapter which will commend itself especially to young officers commanding small craft is that on "Handling Steamers in Heavy Weather." It is probable that, had Lieutenant Smith, R. N., who at the time of his death was commanding the Cobra, been familiar with the contents of this chapter, the frail Cobra would never have been driven into the heavy seas which broke her in two and drowned most of her crew.

The notes on the "Rules of the Road," the chapters on "Manœuvring to Avoid Collision," "The Steering of Steamers," and "Piloting" should be of great practical help to those who must face responsibility at sea. Upon the officer of the watch devolves the tremendous duty of the safe-keeping of hundreds of lives, and of property of enormous value. He needs just the sort of guidance that is offered him here. It is rather surprising that no annotation upon the Rules of the Road has ever been before attempted in a work on Seamanship. Certain features of the Rules have been discussed in pamphlets by Admiral Colomb, and there exists a small work by an English Admiralty lawyer which contains many valuable notes, but these are not within easy reach of seafaring men. The notes here given cover almost every conceivable point of possible doubt or misunderstanding. The chapter on "Manœuvring to Avoid Collision" should be studied point by point by every one who is or may be called upon to take charge of a ship. The section "In a Fog" is especially illuminating and convincing. The author effectively disposes of the fallacy that it is safer to run at high speed in a fog than to slow down, and shows by a series of novel and interesting diagrams not only why this is true, but why the manœuvres which he recommends give the largest chance of safety when vessels are near each other in a fog.

The chapters on "Boats," "Ground Tackles," "Mechanical Appliances," "Blocks and Tackles," and "Handling Heavy Weights," treat of these subjects from the standpoint of modern practice. On page 64 a rule is given for the calculation of the friction when using purchases in hoisting. We read here that "it is a safe general rule to increase the load by ten per cent for each sheave over which the fall leads, and then to consider that this increased load is being lifted by a frictionless purchase. Accordingly, to find the power required by the hauling part, we add the percentage for friction as above, and divide by the number of parts at the movable block." Those who have handled heavy weights with no rule to guide them save the vague generalization "due allowance must be made for friction," will appreciate the great value of this practical quantitative rule.

The text of the book is accompanied by 136 full-page plates, which are so clear that comprehension immediately follows examination. Careful inspection shows that every line has its meaning and that every trifling point is absolutely correct. In these illustrations every part is named, not referred to by numbers which must then be hunted up. The knots illustrated could all be made from the drawings; the plate of the midship section of a battleship makes every part as plain as if the battleship had been sawed into slices and these slices put on the stocks for public view.

The writer of this review, formerly an engineer officer, desires to state that he bought this book when it was first published, which chanced to be at a time when he was preparing for line duties and examination, and that what he has here written is based upon an intimate use of the book for the past two years, during which time it has been of great personal help whenever the advice of a seaman has been needed. It should be of particular service to all former engineers, and to all young officers, and it should be in the personal library of every officer in the service.

It is well known in the naval service that Commander Knight was requested to undertake this work by the Naval Academy authorities, and that during the three years spent in preparing it he was head of the Department of Seamanship at the Academy. But while the book was written especially for Naval Academy use, the fact that two editions have already been exhausted indicates the place it has found for itself in the estimation of the sea-going profession, both of the naval service and the merchant marine. We may content ourselves with believing that for the present it is *the book on Seamanship.*

E. L. BEACH, Lieutenant, U. S. Navy.

"All the World's Fighting Ships." By Fred T. Jane. Published in the United States by Munn & Co., 361 Broadway, New York.

This book can best be described by telling what it is composed of.

It contains a photograph of every warship in the world, and also diagrams showing the guns and armor of each ship. It also gives the length, beam, draft, horse power, speed, coal capacity, number and size of guns, thickness and disposition of armor of every warship in the world.

It contains chapters, written by celebrated critics, on Shipbuilding, Strategy and Tactics, Trials and Experiments, Marine Engineering, Torpedoes, Classification of Ships, Gunnery.

The book is published at simultaneous times in England, France, America, Germany, Russia, Italy, Japan and Sweden.

It contains 394 pages with over 3000 illustrations.

"The Admiral's Aid." A story of Life in the New Navy. By Chaplain H. H. Clark, U. S. Navy. Lothrop Publishing Co., Boston.

The hero of Captain Clark's new story is David Stockton, who has just been graduated from Annapolis. As read by the naval officer, the marked characteristic of this story is its faithfulness to truth, and in this respect it serves a very clearly intended purpose. An officer who has been stationed at the Naval Academy is aware of the numerous inquiries from parents of young men, and of young men themselves, hoping to enter the Naval Academy, and intensely interested in all that concerns the life of the young officer. It is apparent that the purpose of "The Admiral's Aid" is to present the life as it actually is. For many people this can be well done by having this life depicted in an interesting narrative. With this evident intention, David Stockton is followed on board ship, and he is seen at various duties. The life of the young officer on board ship is faithfully depicted. From many years at sea with young officers Chaplain Clark is well capable of telling of this life, and their daily doings, social pleasures, and the life on board warships is faithfully told. These are all combined in a prettily told love story, in which the interest increases as the story proceeds.

Chaplain Clark has had many generations of naval cadets and midshipmen before him; in his book he has paid tribute to them.

The tribute paid to Chaplain Clark by naval officers of all ages is too well known to need comment here.

"A Maker of the New Orient, Samuel Robbins Brown." By William Elliot Griffis. Published by the Fleming H. Revell Company, New Lork.

Dr. Griffis needs no introduction to the members of the Naval Institute, because of two good reasons: first, because he is a member of the Naval Institute, and we hope that this is a matter of as much satisfaction to Dr. Griffis as it is to us; and secondly, because the author of "The Mikado's Empire," "Corea, the Hermit Nation," "Verbeck of Japan," and of 17 other works, many of them books to be found in the libraries of our ships, is known wherever books in the English language are read.

A new volume has come from his pen. He has already told us much of Japan, of its history, of its government, of its people, and of its life. In "A Maker of the New Orient" he tells us of one of the men who had much to do in the creation of New Japan.

We can best understand the principles of the new life of Japan, when, after studying the people as they have been and as they are, we study the life of those men who had most to do in the creation of these principles. And this is what we have in "A Maker of the New Orient."

Samuel Robbins Brown was one of the American pioneers in Japan. He was a minister of God, and was a true missionary to Japan when she first began to aspire to the newer Western civilization. Dr. Brown was early recognized by both Japanese and the newcomers from the west, as a man possessing great powers for the good. This brought him into contact with the great officials and the influential men of New Japan. It was in this way that Dr. Brown was truly "A Maker of the New Orient."

This book gives most interesting details of the Japanese life at the time Japan commenced to aspire to learn of Western nations. It will find a place in the libraries of all who have visited and are interested in that delightful country.

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LIST OF PRIZE ESSAYS.

1879.

Naval Education. Prize Essay, 1879. By Lieut.-Com. A. D. Brown, U.S.N.

NAVAL EDUCATION. First Honorable Mention. By Lieut.-Com. C. F. Goodrich, U.S.N.

NAVAL EDUCATION. Second Honorable Mention. By Commander A. T. Mahan, U.S.N.

1880.

"The Naval Policy of the United States." Prize Essay, 1880. By Lieutenant Charles Belknap, U.S.N.

1881.

The Type of (I) Armored Vessel, (II) Cruiser best suited to the Present Needs of the United States. Prize Essay, 1881. By Lieutenant E. W. Very, U.S.N.

SECOND PRIZE ESSAY, 1881. By Lieutenant Seaton Schroeder, U.S.N.

1882.

Our Merchant Marine: The Causes of its Decline and the Means to be taken for its Revival. "Nil clarius aquis." Prize Essay, 1882. By Lieutenant J. D. J. Kelley, U.S.N.

"MAIS IL FAUT CULTIVER NOTRE JARDIN." Honorable Mention. By Master C. G. Calkins, U.S.N.

"SPERO MELIORA." Honorable Mention. By Lieut.-Com. F. F. Chadwick, U.S.N.

"CAUSA LATET: VIS EST NOTISSIMA." Honorable Mention. By Lieutenant R. Wainwright, U.S.N.

1883.

How may the Sphere of Usefulness of Naval Officers be extended in Time of Peace with Advantage to the Country and the Naval Service? "Pour encourager les Autres." Prize Essay, 1883. By Lieutenant Carlos G. Calkins, U.S.N.

"SEMPER PARATUS." First Honorable Mention. By Commander N. H. Farquhar, U.S.N.

"CUILIBET IN ARTE SUA CREDENDUM EST." Second Honorable Mention. By Captain A. P. Cooke, U.S.N.

1884.

The Reconstruction and Increase of the Navy. Prize Essay, 1884. By Ensign W. I. Chambers, U.S.N.

1885.

Inducements for Retaining Trained Seamen in the Navy, and Best System of Rewards for Long and Faithful Service. Prize Essay, 1885. By Commander N. H. Farquhar, U.S.N.

1886.

What Changes in Organization and Drill are Necessary to Sail and Fight Effectively Our Warships of Latest Type? "Scire quod nescias." Prize Essay, 1886. By Lieutenant Carlos G. Calkins, U.S.N.

THE RESULT OF ALL NAVAL ADMINISTRATION AND EFFORT FINDS ITS EXPRESSION IN GOOD ORGANIZATION AND THOROUGH DRILL ON BOARD OF SUITABLE SHIPS. Honorable Mention. By Ensign W. L. Rodgers, U.S.N.

1887.

The Naval Brigade: its Organization, Equipment and Tactics. "In hoc signo vinces." Prize Essay, 1887. By Lieutenant C. T. Hutchins, U.S.N.

1888.

Torpedoes. Prize Essay, 1888. By Lieut.-Com. W. W. Reisinger, U.S.N.

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The Enlistment, Training and Organization of Crews for our Ships of War. Prize Essay, 1891. By Ensign A. P. Niblack, U.S.N.

DISPOSITION AND EMPLOYMENT OF THE FLEET: SHIP AND SQUADRON DRILL. Honorable Mention, 1891. By Lieutenant R. C. Smith, U.S.N.

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Torpedo-boats: their Organization and Conduct. Prize Essay, 1892. By Wm. Laird Clowes.

1894.

The U.S.S. Vesuvius, with Special Reference to her Pneumatic Battery. Prize Essay, 1894. By Lieut.-Com. Seaton Schroeder, U.S.N.

NAVAL REFORM. Honorable Mention, 1894. By Passed Assistant Engineer F. M. Bennett, U.S.N.

1895.

Tactical Problems in Naval Warfare. Prize Essay, 1895. By Lieut.-Com. Richard Wainwright, U.S.N.

A SUMMARY OF THE SITUATION AND OUTLOOK IN EUROPE. An Introduction to the Study of Coming War. Honorable Mention, 1895. By Richmond Pearson Hobson, Assistant Naval Constructor, U.S.N.

SUGGESTION FOR INCREASING THE EFFICIENCY OF OUR NEW SHIPS. Honorable Mention, 1895. By Naval Constructor Wm. J. Baxter, U.S.N.

THE BATTLE OF THE YALU. Honorable Mention, 1895. By Ensign Frank Marble, U.S.N.

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The Tactics of Ships in the Line of Battle. Prize Essay, 1896. By Lieutenant A. P. Niblack, U.S.N.

THE ORGANIZATION, TRAINING AND DISCIPLINE OF THE NAVY PERSONNEL AS VIEWED FROM THE SHIP. Honorable Mention, 1896. By Lieutenant Wm. F. Fullam, U.S.N.

NAVAL APPRENTICES, INDUCEMENTS, ENLISTING AND TRAINING. The Seaman Branch of the Navy. Honorable Mention, 1896. By Ensign Ryland D. Tisdale, U.S.N.

THE COMPOSITION OF THE FLEET. Honorable Mention, 1896. By Lieutenant John M. Ellicott, U.S.N.

1897.

Torpedo-boat Policy. Prize Essay, 1897. By Lieutenant R. C. Smith, U.S.N.

A PROPOSED UNIFORM COURSE OF INSTRUCTION FOR THE NAVAL MILITIA. Honorable Mention, 1897. By H. G. Dohrman, Associate Member, U.S.N.I.

TORPEDOES IN EXERCISE AND BATTLE. Honorable Mention, 1897. By Lieutenant J. M. Ellicott, U.S.N.

1898.

Esprit de Corps: A Tract for the Times. Prize Essay, 1898. By Captain Caspar Frederick Goodrich, U.S.N.

OUR NAVAL POWER. Honorable Mention, 1898. By Lieut.-Com. Richard Wainwright, U.S.N.

TARGET PRACTICE AND THE TRAINING OF GUN CAPTAINS. Honorable Mention, 1898. By Ensign R. H. Jackson, U.S.N.

1900.

Torpedo Craft: Types and Employment. Prize Essay, 1900. By Lieutenant R. H. Jackson, U.S.N.

THE AUTOMOBILE TORPEDO AND ITS USES. Honorable Mention, 1900. By Lieutenant L. H. Chandler, U.S.N.

1901.

Naval Administration and Organization. Prize Essay, 1901. By Lieutentenant John Hood, U.S.N.

SPECIAL NOTICE.

NAVAL INSTITUTE PRIZE ESSAY, 1904.

A prize of one hundred dollars, with a gold medal, is offered by the Naval Institute for the best essay presented on any subject pertaining to the naval profession, subject to the following rules:

1. The award for the prize shall be made by the Board of Control, voting by ballot and without knowledge of the names of the competitors.

2. Each competitor to send his essay in a sealed envelope to the Secretary and Treasurer on or before January 1, 1904. The name of the writer shall not be given in this envelope, but instead thereof a motto. Accompanying the essay a separate sealed envelope will be sent to the Secretary and Treasurer, with the motto on the outside and writer's name and motto inside. This envelope is not to be opened until after the decision of the Board.

3. The successful essay to be published in the Proceedings of the Institute; and the essays of other competitors, receiving honorable mention, to be published also, at the discretion of the Board of Control; and no change shall be made in the text of any competitive essay, published in the Proceedings of the Institute, after it leaves the hands of the Board.

4. If, in the opinion of the Board of Control, the best essay presented is of insufficient merit to be awarded the prize it may receive "Honorable Mention" or such other distinction as the Board may decide.

5. Any essay not having received honorable mention, may be published also, at the discretion of the Board of Control, but only with the consent of the author.

6. The essay is limited to fifty (50) printed pages of the Proceedings of the Institute.

7. All essays submitted must be either type-written or copied in a clear and legible hand.

8. In case no essay is awarded the prize, the writer whose essay is first in order of merit will, if his essay has received honorable mention, be made a life member. Additional recognition of the merits of papers may be made by the Board at its discretion.

9. In the event of the Prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of a gold medal.

By direction of the Board of Control.

E. L. BEACH,
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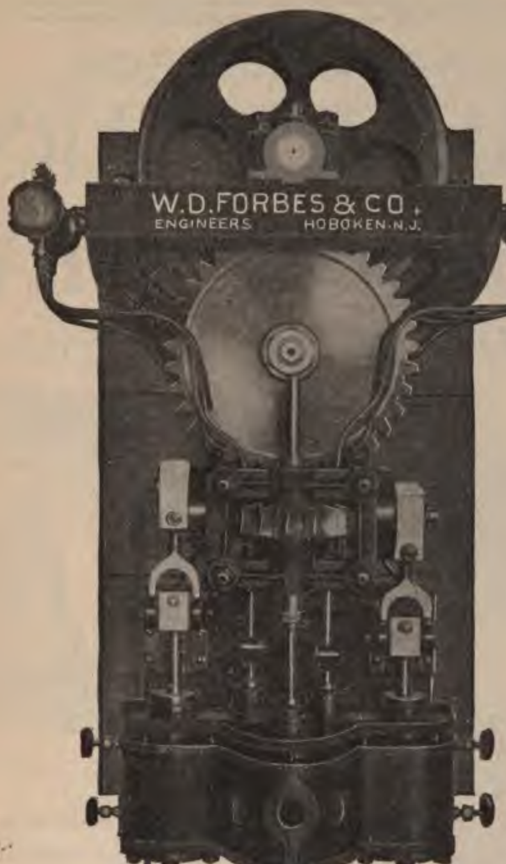

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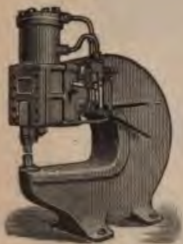


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